SCIENTIFIC AMERICAN

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THE ITALIAN WAR SHIP ITALIA.

In our paper for May 26 last we gave an engraving of the gigantic Italian war ship Italia. We now present an illustration showing how her great guns are arranged, for which, and the following particulars, we are indebted to *Engineering:*

	ft. in.
Length between perpendiculars	400 6
Breadth of beam at water line	73 9
Breadth of beam at upper deck	65 6
Draught of water forward	26 6
Draught of water aft	30 6
Draught of water mean	28 0
Area of immersed midship section	1,770 sq. ft.
Displacement at load draught	13,480 tons.
	ft. in.
Length of armored tower on fore and aft line	88 6
Breadth of armored tower across ship (extreme)	72 6
Length of armored tower *per se*	96 0
Breadth of armored tower	52 9
Distance of stem from armored tower	170 0
Thickness of side of tower, including armor	3 3
Thickness of armor on tower	0 21
Thickness of armor on breastwork	0 18
Height of center of heavy guns above water line	32 8
Height of top of tower above water line	30 0
Height of upper deck above water line, forward	25 0
Height of upper deck above water line, aft	23 0
Height of upper deck above water line, amidships	22 6
Height between upper deck and battery deck	7 9
Height between battery and second deck	7 9
Height between second and armored deck	7 6
Depth lower deck below water line, amidships, sides	5 6
Depth of hold under lower deck	21 0
Extension of ram beyond forward perpendicular	6 4
Distance of point of ram below water line	8 6

Machinery.

Number of engines	4 sets.
Number of cylinders	12
Number of propellers	2
	ft. in.
Diameter of propellers	19 6
Number of boilers	26
Number of furnaces (three to each boiler)	78
Total grate area	1,521 sq. ft.
Length of ship, fore and aft, occupied by engines, coal, and boilers	ft. in. 250 0

The estimated weights of the hull, armor, etc., were given approximately as follows:

	Tons.
Hull	5,000
Armor of armored deck	1,200
Armor of citadel	900
Armor of ammunition shaft	246
Armor of chimneys	552
Total weight of armor	2,898
Teak backing	114
The total weight of the machinery is about	2,200

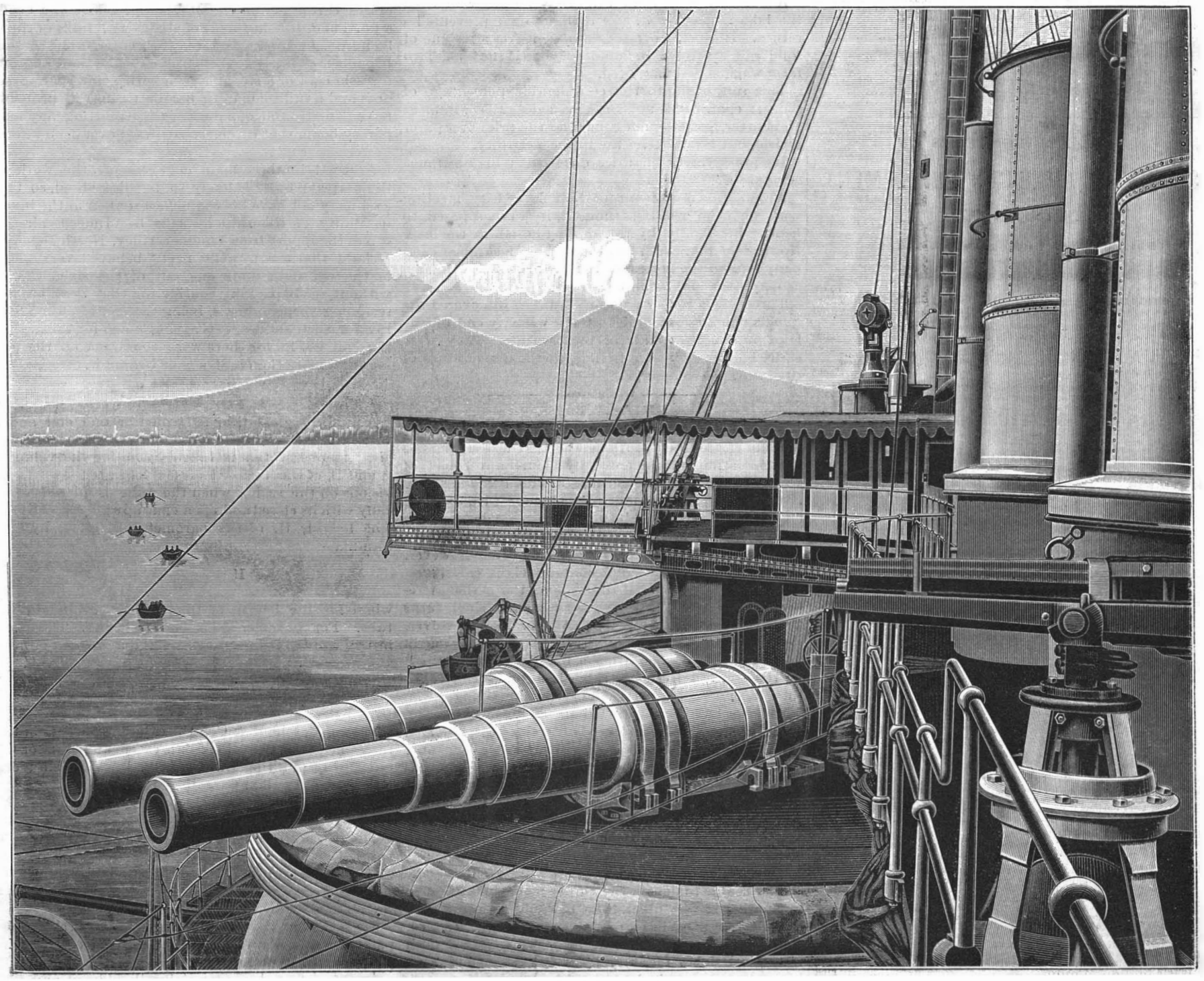
The armament consists of four 43 cm. (110 ton) R. L. R. guns supplied by Armstrongs. There are eight 15 cm. (6 in.) Armstrong breechloaders. Six of these are carried on the upper deck, two being respectively bow and stern chasers. There are six smaller quick-firing guns of 57 mm. caliber.

There are machine guns, comprising twenty-two Hotchkiss and quick-firing guns for the boats and landing parties. There will also be a number of Maxim guns.

There are four torpedo ports arranged on the broadside, two ahead and two astern.

Remarkable Tunnels.

Among the great tunnels which have been excavated, says a writer in *Scribner's Magazine*, the St. Gothard is the most remarkable. It is 9¼ miles long, with a section 26¼ feet wide by 19⅔ feet high. The work on this tunnel was continuous, and it required 9¼ years for its completion. The Mont Cenis tunnel, 8⅓ miles in length, was completed in twelve years. The Hoosac tunnel, 4¾ miles in length, 26 feet wide and 21½ feet high, was not prosecuted continuously; it was completed in 1876. These tunnels are notable chiefly on account of their great length; there are others of more moderate extent which have peculiar features; one is unique. This tunnel is a portion of the St. Gothard railway, and not very far distant from the great tunnel referred to above. In the descent of the mountain it was absolutely necessary to secure a longer distance than a straight line or an ordinary curve would give. The line was therefore doubly curved upon itself. It enters the mountain at a high elevation, describes a circle through the rock, and, constantly descending, reappears under itself at the side; still descending, it enters the mountain at another point and continues in another circular tunnel until it finally emerges again, under itself, but at a comparatively short horizontal distance from its first entry, having gained the required descent by a continued grade through the tunnels.



THE ITALIAN WAR SHIP ITALIA.

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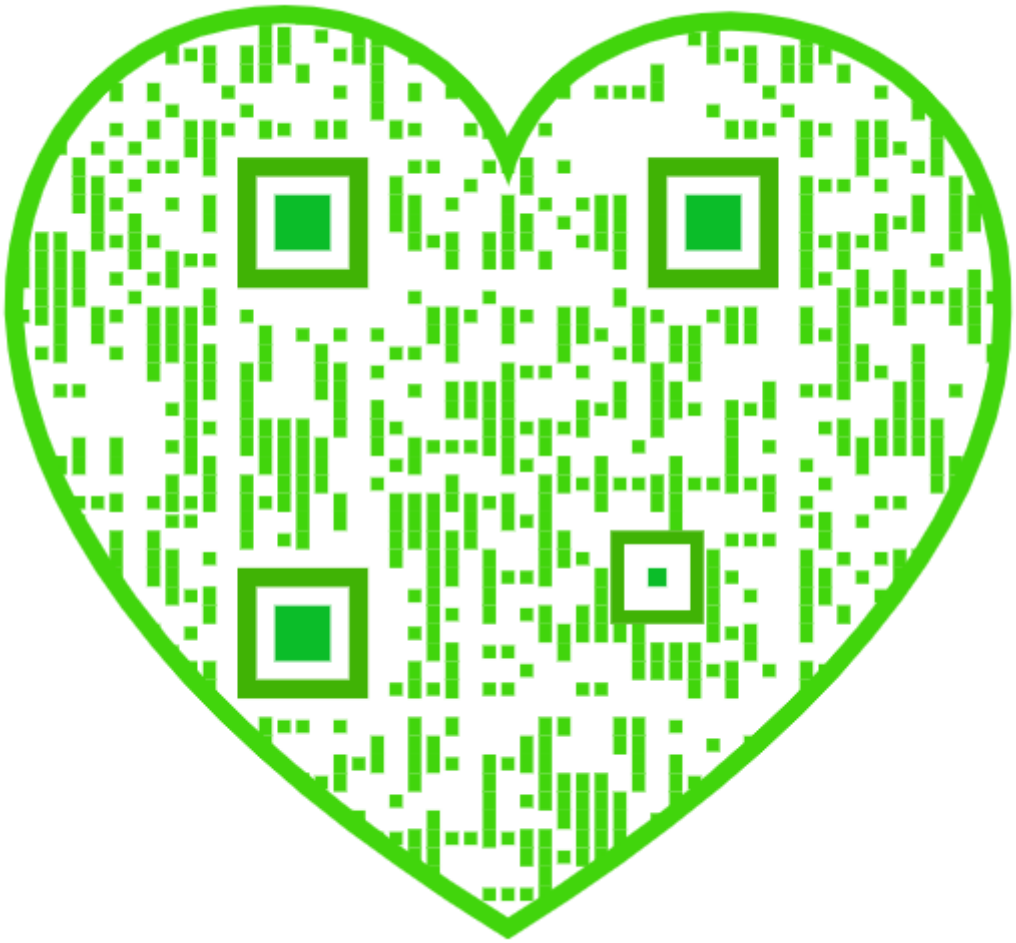

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ARTESIAN WELLS IN UTAH.

It has of late been discovered that flowing wells of water can readily be obtained by boring from one hundred to two hundred feet in depth in all that part of Utah lying northerly about one hundred miles and southerly about two hundred miles from Salt Lake City, and in the San Pete Valley.

This part of the Territory is thickly settled. Towns of from 500 to 5,000 population are numerous, and farmers and town residents are availing themselves of this abundant and easily obtained supply to the partial neglect of the old method of irrigating ditches.

A good flowing well will irrigate five or six acres, saving the expense of a yearly water tax and having the water daily at command, to be turned on or off as desired.

Nearly every residence in the beautiful city of Provo has its own artesian well, part of which is frequently utilized in a fountain in the front yard, throwing a copious jet thirty feet into the air, while hydrants are stationed at intervals in the garden, barn, and elsewhere about the grounds. For farmers and others it could also be used where light power for churning, sawing wood, thrashing, etc., is needed.

A stranger passing through a village, and not knowing the source of supply, would attribute it to a system of water works. The water is turned off and on by faucets, and is easily controlled.

The green lawns, the luxuriant gardens, and abundance of thrifty fruit and shade trees are in marked contrast to regions dependent on rainfall for their water supply.

These wells are being rapidly extended, and it is hoped that much of the Territory heretofore considered out of the reach of irrigation will soon be brought under cultivation.

SALT AT SALT LAKE, UTAH.

The manufacture of salt around the shores of Salt Lake, Utah, is an important and growing industry.

Nearly all the land adapted to the purpose has been appropriated by settlers.

A level meadow is usually selected, a few inches above and adjacent to the water of the lake.

The surface of the soil is scraped and made level and hard like the floor of a brick yard.

A storm or high wind will drive the water in from the lake and cover it, and a slight dam prevents its return. It quickly evaporates and leaves a residue of solid salt six to ten inches deep, that is shoveled into farm wagons and marketed.

This salt, owing to the considerable percentage of soda it contains, is not considered desirable for meat and butter, and does not command the price of a purer article, but is in general use in the Territory.

Its preservative qualities once cost a life insurance company $5,000.

A well-known resident of Salt Lake City, meeting with financial reverses, thought, it was supposed, to benefit his family by drowning himself in the lake. No trace of him could be found. The insurance company refused the insurance to the widow and orphans, as no proof could be brought of his death.

Three years afterward some hunters discovered the remains in a remote inlet at the westerly end of the lake, in a perfect state of preservation. They were easily identified by his friends, to the discomfiture of the insurance company.

MILITARY NOTES.

An interesting bit of news that crossed the ocean last week in the military journals was that concerning the new magazine rifle invented by Lieutenant Dohet, of the 14th regiment of the line, of the Belgian army. Save in length, it has much in common with our own "Colt" revolver, there being a revolving drum at the base of the barrel; the mechanism for loading, throwing out the empty shell and recharging being, however, quite different. The drum contains eight cartridges, according to *L'Avenir Militaire*, and the action of recocking the piece throws out the empty shell, turns the drum, as is the case with the ordinary revolver. But no sooner has the empty receptor clicked home in its new position, when, from a magazine in the small of the stock, a fresh cartridge is automatically shot into it, and so on till each of the remaining seven cartridges has been duplicated. This, as will be seen, makes the gun's total fire without reloading 16 shots, a veritable pepper box indeed; and when we remember that every man in a line of battle where such arms were used could fire sixteen shots in quick succession and then fall back to reload, only to make way for a second line similarly armed, the formidable character of the arm is apparent. In no gun thus far devised with a pocket magazine under the breech has the maximum been more than six shots, and unless the average soldier is able to detach the empty magazine and clap on another in very quick time, it would seem that this new Belgian piece has a palpable advantage. Indeed, should it prove as efficient as is promised, a dash through Belgian territory by either French or Germans may come to be looked upon as quite impracticable.

The Austrians are astonished at the remarkable accomplishment of the Maxim machine gun. The *Wiener Militar Zeitung*, commenting upon some recent tests made by the general staff of the Austro-Hungarian army, says of this gun:

It's more like a human being than a gun, and even this seems only scant praise, so accurate is the automatic apparatus; for indeed the average soldier could not be trusted to throw out the empty shells, put loaded ones in their places, and keep the cooling mechanism so constantly and evenly at work as is done with the power gathered from the recoil. Here is the record of the tests, the distances being given in meters:

Distance.	No. Shots Fired.	Time in Sec.	No. Shots to the Min.
200	30	3·0	600
400	30	3·0	600
600	40	4·3	558
800	40	4·3	558
1,000	40	4·0	600
1,200	40	4·0	600
1,400	60	5·8	620
1,575	60	6·0	600

The deliberate opinion of the Austrian officers making the test is reported by the authority quoted to be that this machine gun is superior to all others in quickness of firing and loading, though not so accurate as some others.

The sham battle between two British squadrons under the respective commands of Admirals Tryon and Baird is now, and likely for some time to be, the chief topic of discussion between artillerists as well as naval officers. The fighting capacity of the present type of armored ship may fairly be called an unknown quantity, for there have been no maritime wars since they were designed. It is, therefore, left for the judges to decide arbitrarily as to how near one ship may approach two of the same type without getting her *coup de grace*. But, aside from the pounding and ramming power of these great ships, which must needs wait for real war to find their exemplification, the steaming qualities, the facility in turning, in getting the guns to bear, in keeping the line of battle and in general maneuvering, may readily be measured in the present sham fight. The squadron under Tryon is constructing a great boom across the approaches to Berehaven, which recalls the really formidable boom the Confederates threw across the Mississippi above the bend; a portion of it being made of chains with links of three-inch iron, and welded across the center. The present boom is not likely to be stronger than that, and one torpedo boat or a steam launch with a few spar torpedoes and a skillful man to handle them will probably have little trouble of a dark night in cutting any temporary boom that can be constructed over deep water.

As usual in these sham engagements, the work of the torpedo boats is likely to be discredited, so that Jack may not have his confidence shaken in the invulnerability of the ship he sails in. Indeed, already comes the report from Lough Swilley, North Donegal, Ireland, that the torpedo fleet "behaved very badly on the way out;" only one out of the six getting in without mishap. But considering that these are not sea-going torpedo boats, being too short and too narrow for such service, it is saying much for them that they all got in, for there was a rough sea on the passage and more than half a gale behind it.

A New Barometer.

A uniform glass tube is sealed at one end and a thread of mercury introduced, inclosing a quantity of air. An observation is taken by noting the volumes, A and B, of the inclosed air (as indicated by the divisions on the scale), when the tube is placed vertically with its closed and open ends upward respectively. The height, H, of the barometer is given by the formula—

$$H = \frac{A+B}{A-B} l$$

where l is the length of the mercury column in the tube. For convenience l is made 10 inches. The whole instrument is very portable, weighing only six ounces, and measuring about 18 inches long.—*By Mr. T. H. Blakesley, M.A.*

Painting a Tin Roof.

Messrs. Merchant & Co., the extensive dealers in tin, recommend the following as an excellent paint for the purpose of painting tin roofs: 10 lb. Venetian red, 1 lb. red lead, 1 gallon pure linseed oil.

The substitution of benzine or fish oils for the pure linseed oil should not be allowed.

The roof will last longer and be less liable to rust if painted on the under surface before laying. It is a good plan to put one or two layers of felt paper under the tin to serve as a cushion for same, and to deaden the noise made by the rain falling on the tin.

A year after the first coating the roof should be painted again, and then a good roof will only require painting once in four years.

A roof of first-class material well soldered and properly laid should last forty years.

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Sending Live Lobsters to California.

The United States Fish Commission shipped from Wood's Holl, June 16, 600 live lobsters and 250,000 lobster eggs. Of the former, 350 arrived safely in Sacramento, Cal., June 22, and they have been deposited in the Pacific north and south of San Francisco. Several previous attempts to take live lobsters across the continent have failed. Of those sent only as far as Chicago, packed in seaweed in crates, only one in four survives.

Colonel McDonald, fish commissioner, personally superintended the packing of the lobsters lately sent to California. A crate or box devised by the late Captain Chester was used. This was placed within another larger box, the intervening space being filled with pounded ice. In the inner box the lobsters were placed between layers of rockweed, which at times was moistened with sea water. Each box had an independent drain, so that the fresh water from the melting ice could not enter the lobster box. The temperature of the latter was kept at 45° F. A fish commission car was used, the boxes along the side of it serving as the outer box of the combination described above; one hundred crates, each containing six lobsters, being placed in them, and surrounded with ice. Each morning before sunrise a careful inspection of the lobsters was made, and those that had died were removed. The first day 45 died; the second day, 55. After that the mortality was much less. All of those that died were in an advanced state of shedding, and were in poor condition when they started.

One-half of the 350 lobsters that arrived safely on the Pacific coast were placed in the ocean north of San Francisco, and the other half south. It is hoped that this experiment may demonstrate the feasibility of stocking the waters of the Pacific on the California coast north of Monterey with this delicious shell fish. The condition of the water in that region is quite similar to that of the Atlantic off the Massachusetts coast. The temperature is about the same, except that it is more constant. The lobster on the Massachusetts coast crawls out into deep water in the summer, where the temperature is low, but it is thought that the equable temperature of the Pacific will enable the lobster in those waters to spend the whole year in one spot.

Hatching apparatus was taken to California with the 250,000 lobster eggs shipped. The young lobsters produced by these eggs will be deposited in the sea at once. Although a fair trial will be made to determine the possibility of stocking the Pacific by artificial propagation, much more confidence of success is expressed by Colonel McDonald from the introduction of mature lobsters. The young lobsters have to be placed in the sea almost as soon as they are hatched, and begin to feed most voraciously, even devouring each other. For a few days they swim on the surface of the water, where they find food suited to their requirements, but where they also encounter millions of enemies. After their walking or crawling organs are developed, they sink to the bottom, which they then make their home. One of the problems which the United States fish commissioner is now attempting to solve is the invention of some method of keeping the little lobsters in confinement and safety after they are hatched until they have attained sufficient strength and size to enable them to protect themselves. The importance of such an invention will be appreciated when it is known that, from the 12,000 to 15,000 eggs produced by a female lobster in a year, not more than two lobsters, when left to nature, become full grown. Not only are almost all the little lobsters destroyed by their enemies, but a large proportion of the eggs are devoured by fish and sea birds before they are hatched. If, after artificially hatching the eggs, the fish commission could protect the young lobsters until they are large enough to take care of themselves, the supply of lobsters, which is now hardly equal to the demand, and would not one-half supply it if the price was reduced, might be increased almost indefinitely.—*Science.*

Aztec Mummies.

Sig. S. Marghieri, the well known archæologist, discovered and explored a hermetically sealed cave, at an elevation of nearly 4,000 feet, on the eastern side of the Sierra Madre Mountains in Mexico, about 200 miles south of Deming, between Coralitos and Casa Grande, about two years ago. The floor was nearly smooth, the sides rough and rugged, and the vault covered with stalactites. In the far end of the cavern were found four desiccated human bodies.

The bodies were in a sitting posture, with the hands crossed on the breast, and the knees approaching the chin, with the head inclined forward. They were carefully shrouded in their burial garments, and placed facing the rising sun. The male and female were seated side by side. The older child, a boy, was at the right of the father, and the younger child, a girl, at the left of the mother. In addition to the funeral shrouds, the little girl was enveloped in the skin of an animal, similar to the method used in the island of Fuerte Ventura, the better to preserve its tender frame.

The floor of the cavern and the remains were covered with a fine dust, but no footprints of man or beast could be found. The bodies were carried to San Francisco by Signor Marghieri, and were purchased by J. Z. Davis, President of the Board of Trustees of the State Mining Bureau, and by him presented to the Bureau.

No embalming process was used in the preservation of these bodies. They were dried by the air alone. The bodies are not like those of the Indians of the present day, because the fingers and hands and feet are smaller than the average, and the woman's hair is brown and silken, and of the Caucasian type. The body of the man must have weighed in life from 180 to 200 pounds, but it now weighs only 14 pounds, while the body of the woman weighs only 12 pounds. In the lobe of each of the small and well proportioned ears is a piece of hollow bamboo or reed as an ornament. The woman had a large forehead and well developed reasoning powers.

The little boy weighs but three pounds, and the girl only four and a half pounds.

The burial shrouds on the bodies are composed chiefly of cotton, hair, hide, grasses, and the bark of willows.

The bodies may now be seen at the rooms of the State Mining Bureau.—*San Francisco Examiner.*

Electric Welding.

At the recent annual meeting of railway telegraph superintendents, the following paper on "Electric Welding," by Otis K. Stuart, was read:

The process of electric welding which was discovered by Prof. Thomson some eleven years ago, while lecturing at the Franklin Institute of Philadelphia, has been developed in the past two years to a far greater extent than is generally supposed. We started in with the welding together of small wires of iron and copper, and have been so successful in the development of apparatus that we are now able to weld bars of a very large size and of almost any shape or metal.

The principle involved is that of forcing through a conductor an amount of current that the conductor will not carry without heating. Any conductors, when placed in abutment, have as their point of greatest resistance the point of abutment or contact, and consequently it is at this point that the heat is first generated; and, as is well known, this heat increases the resistance of the conductors at that point so greatly that more heat is developed at a remarkably rapid rate.

A consideration of the above facts will prove at once one of the advantages of electric welding, as practiced by Prof. Thomson, namely, the localization of the heat to the points or point at which it is desired, thus saving an enormous amount of energy which is usually wasted in welding with the forge or flame. So absolutely is the heat localized, that pieces of iron 3 inches long and an inch in diameter can be welded together and then held in the hands for some time without any danger of burning, the only heat which is felt at all being that which is conducted along the metal to the hands after the welding is completed.

A further consideration of these facts will also demonstrate that it is possible by the Thomson process to weld any metal, including even those which melt at a very low temperature, such as lead, zinc, and tin, and those which melt at enormously high temperatures, as, for instance, iridium, platinum, etc. Of course it goes without saying that we can weld any of the metals used in ordinary manufacture.

It is plain that if the heat is developed so rapidly, a very delicate means of controlling it must be provided, and we are glad to say that we have been able to provide arrangements for this purpose which are almost absolutely perfect—I am inclined to say absolutely perfect for the reason that the control of the current can be made entirely automatic.

We are able to take a bar of inch iron, 4 inches in length, raise it to a dull red in 20 seconds, and hold it there for an indefinite period; to increase the heat to a bright red in a very few seconds and hold it there, then to still further raise the temperature to a welding or vaporizing point in a remarkably short space of time. This indicates the delicacy of this apparatus, and I would add that no very great skill is required to operate the machine, a boy learning to weld iron and steel with great facility in a week or two. The time required to weld metals depends, of course, upon the power of the apparatus and the skill of the operator. We have made strong and practically perfect welds in half inch round wrought iron in 6 seconds, in inch round wrought iron in 45 seconds, and so on. Experiments have proved to us that the power required to weld is proportional, or very nearly so, to the area of cross section of the pieces. This is true of nearly all the metals, though, of course, the relative resistance and welding temperature of the several metals may interfere with this ratio.

For welding small wires, such as telegraph or telephone, and the smaller sizes of electric light and power lines, the power required is very small indeed, the momentum of heavy machinery being more than enough to effect the weld. In this connection I desire to say that we are now working to perfect an apparatus for welding telegraph, telephone and electric light wire, and lines of pipe on the line. Our experiments in this direction have been successful, and we now think it possible to construct an apparatus which will be capable of being moved about by one or two men, which will make joints in wires correctly and durably, the energy used being supplied by storage battery or batteries, forming a part of the welding outfit. For repair work and in general construction it is our belief that this apparatus will be found very useful and effective. In fact, we hope to do away entirely with the ordinary solder and link joints used at present.

The policy of placing an apparatus on the market has been adopted for the reason that our patents cover not only the apparatus for electric welding, but the art or process as practiced by Prof. Thomson. It is hardly necessary to add that by the same process we can solder and braze, and anneal and temper, and do other heating, local or otherwise, which cannot be done economically by present methods. All these operations can be performed with the same apparatus, though, of course, it is better to have machines especially constructed for particular work.

Mr. G. L. Lang stated that he had seen one of these machines in operation when a bar of cast steel and one of copper were welded together. One would suppose that the metal most easily fused would burn away before the other was brought to a welding heat. This is not the case, however, and it is very simply provided against. The current is brought to the bars through clamps which grasp the bars near to the ends to be welded. Where copper and steel are to be welded together, the clamp is placed about 6 in. back on the copper bar, while it is only about 1 in. from the point of contact on the steel bar. In this case the heat is diffused through a large body of the metal which is most fusible, so that they are both brought to a welding point at the same time. The process is something really wonderful, and promises to revolutionize the ordinary method. The system is now in constant use at the Thomson-Houston factory in Lynn, Mass.

Improvement in Saccharin.

A great objection to saccharin is its very sparing solubility when pure. The defect is corrected by the addition of an alkaline bicarbonate, but it is often at the expense of the sweetening properties of the chemical, which sometimes acquires almost a bitter taste. Flies, bees, and other insects will not touch saccharin in any shape, but as man, who is not so good a judge of sweets, likes it, let it at least be cooked up and served to his taste. M. P. Mercier recommends the following process: Take of—

Pure saccharin	10 parts.
Distilled water	5 "
Sodium bicarbonate	4–5 "
Alcohol (95 per cent)	20 "
Sulphuric ether	sufficient.

The bicarbonate is to be added by small portions to the saccharin mixed with the water, about half an hour being allowed to pass between each addition, and the mixture being stirred occasionally to hasten the combination and the evolution of carbonic acid gas. It is important to cease adding bicarbonate before the saccharin is entirely saturated. The operation requires ten to fifteen hours. Next the alcohol is added to the mixture, with the effect of throwing down most of the soda saccharinate, and holding in solution the excess of saccharin and impurities; and, finally, the magma is thrown on a vacuum filter, where it is washed, first with more alcohol, and lastly with sulphuric ether. On drying in the open air, a white, exceedingly sweet, and soluble crystalline powder is obtained, which possesses all the properties of saccharin. Some of the chemical features of the foregoing processes may be briefly alluded to.

It will be noticed, for instance, that no heat is employed. The reason is that under the influence of heat soda will readily transform saccharin into salicylic acid. Then the use of bicarbonate instead of carbonate of soda is not indifferent, as the presence of caustic soda, always to be feared in carbonate, will turn the saccharin into a *para*-compound possessing no sweetness. Lastly, the use of alcohol as a precipitating agent renders heat unnecessary, and removes many impurities to be found in the purest commercial saccharin.—*Chem. and Druggist.*

Circulation of the Blood in the Eye.

"At Professor Hirschberg's clinic, in Berlin," writes a correspondent of the *Kansas Medical Index*, "my attention was called to the fact that the circulation of blood in the blood vessels of the cornea affected with pannus can be seen. If one could not see this in America, it might almost be worth a trip across the ocean. By the aid of a strong lens one sees the circulation here almost as well as in the web of a frog's foot or in a fish's tail."

TURPENTINE and black varnish, put with any good stove polish, is the blacking used by hardware dealers for polishing heating stoves. If properly put on, it will last throughout the season.

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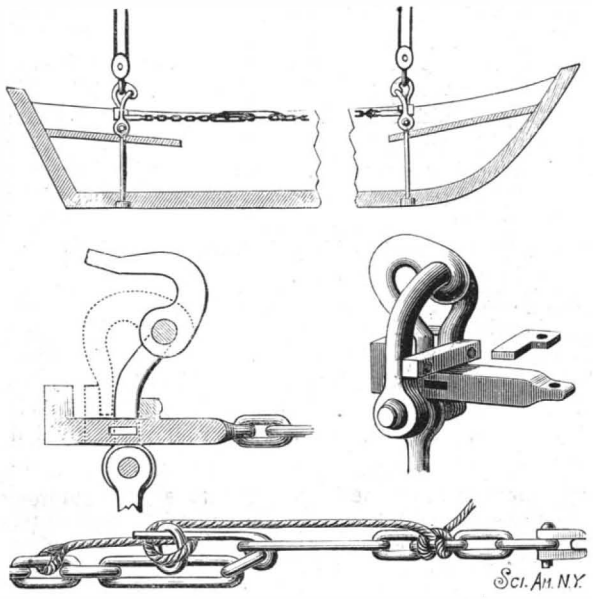
AN IMPROVED BOAT DETACHING APPARATUS.

An apparatus which can be adapted to a boat in any position on the side, quarter, or stern of a vessel, for detaching boats to be launched, and for again reattaching them to the hoisting tackle, is illustrated herewith, and has been patented by Lieut. Alexander McCrackin, U. S. navy, steamship Pinta, Sitka, Alaska. Arranged for connection with a hoisting sling, a shackle is employed which carries a loose hook that is mounted to turn upon the bow of the shackle, the hook having a straight point or end that fits into a keeper formed

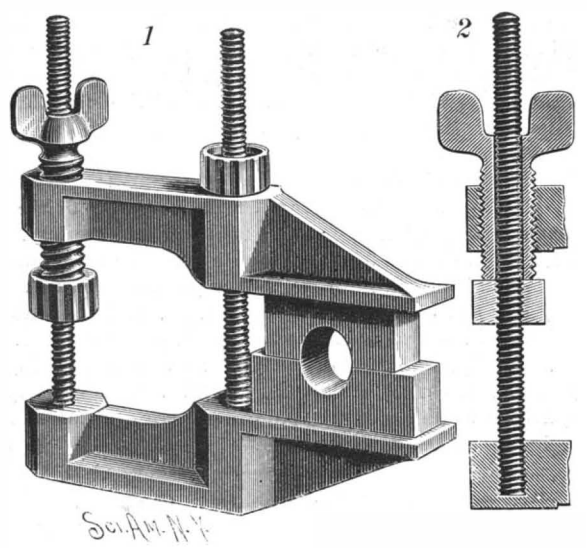


McCRACKIN'S BOAT DETACHING APPARATUS.

upon a sliding bar or bolt, which passes beneath a transverse bar secured to the arms of the shackle. A key is arranged to fit within an aperture of the sliding bar or bolt, by which the latter may be locked to place upon the shackle to hold the hook in closed position. Two such devices are employed, connected by a small chain or its equivalent, made in two parts, joined by a slip hook of novel construction, the arrangement being such that when two sections of the chain are connected by the slip hook, and the chain is drawn taut, the two bars or bolts will be held in position, and prevented from slipping outward to release the hooks turning on the bows of the shackles. When a boat is to be lowered and detached, the lanyard used in connection with the slip hook is cast off, and, the keys locking the sliding bars in the arms of the shackles having been previously removed, the weight of the boat and crew will turn the hooks to allow the boat to drop freely into the water, both hooks being released instantly and simultaneously, and their connecting chain dropping harmlessly on the thwarts, out of the way of the masts and oars.

AN IMPROVED CLAMP.

A hand clamp in which there are no projections from outside the fixed jaw to be in the way, and in which there is no twisting strain on the screw rods, enabling them to withstand the strain of heavier work, has been patented by Mr. Wendell P. Tarbell, of Milford, N. H., and is illustrated herewith, Fig. 2 showing a vertical section on the line of the inner screw rod of the clamp.



TARBELL'S CLAMP.

Two screw-threaded rods are socketed in the fixed jaw of the clamp, the movable jaw moving freely on these rods, on each of which a thumb nut is mounted, on the outer rod above and on the inner rod below the movable jaw. The inner screw rod also passes freely through a hollow screw with an operating thumb nut mounted in a screw-threaded socket piece of the movable jaw. The hollow screw is formed with a pitch differing from that on the rod, so that the screw will travel faster or slower than the thumb nut on the same rod, giving a differential movement between it and the nut, affording a greatly increased leverage. With the parts in position as shown in Fig. 1, the article to be clamped being between the jaws, the thumb nut on the outer rod is first screwed down against the movable jaw and the thumb nut on the inner rod is moved up against the end of the hollow screw. The jaw can then be tightened by operating the hollow screw by its thumb nut, which causes the nut bearing against its end to be turned by frictional contact, forcing the hollow screw upward, and exerting a lever action upon the movable jaw, causing it to tilt on the rod, and further tighten the clamp made between the jaws. In a modified form of this device a friction lever is used in place of the hollow screw to tighten the nut. Any desired clamping power can be had from this construction without the use of a wrench or other outside appliance.

A Smoke Filter.

There was recently an exhibition, on a piece of land adjoining Victoria Mansions, of Loeb's appliances which are designed to enable the wearer to breathe and work with comfort in dense smoke, and also in poisonous gases. The device consists of a respirator with an india-rubber mouthpiece. The respirator is held by two projections, which are grasped between the teeth and a flange which lies between the teeth and the lips, additional security being provided by an elastic band passing round the head. The air is drawn in by the wearer through a series of small filters, containing respectively wet sponge, cotton wool, cotton wool damped with glycerine, and animal charcoal.

These filters are very lightly packed, so that there is no resistance to the act of inspiration, and they are provided with valves which direct the air expired from the lungs into the external atmosphere. The entire apparatus weighs less than a pound, and can be used without previous practice. When it is to be employed in an atmosphere which is deadly in its character, as in the choke damp of mines, the air is drawn from some place where it is pure through a light india-rubber tube. The filter is then strapped to the waist of the wearer, and the respirator merely contains the valves which cause the air to be drawn through the pipe and then to expire into the atmosphere. A tube up to 100 feet in length can be manufactured with facility. Protection is afforded to the eyes by a pair of spectacles with india-rubber rims, which press tightly on the cheek and brow, and exclude all smoke. Mechanical wipers are added to enable the glasses to be cleaned without removal.

At a recent trial in London, says *Engineering*, a man wearing the respirator spent half an hour in a building filled with dense smoke of a most pungent character, without any difficulty, and afterward the inventor's representative, with the aid of a flexible air pipe, entered a room containing a dish of burning sulphur and remained there some time. It was clearly demonstrated that the respirator would enable the wearer to enter a building filled with smoke and discover the exact position of a fire. A few buckets of water promptly applied under such circumstances will do more good than the jet from a steam fire engine directed at random. On board ship, where the result of a fire is to fill the hold with smoke, this respirator would be most useful, and this fact has been recognized in the German navy, where Loeb's respirators form part of the official equipment. Many of the German fire brigades have also adopted them.

Constant Pressure when Distilling under Reduced Pressure.

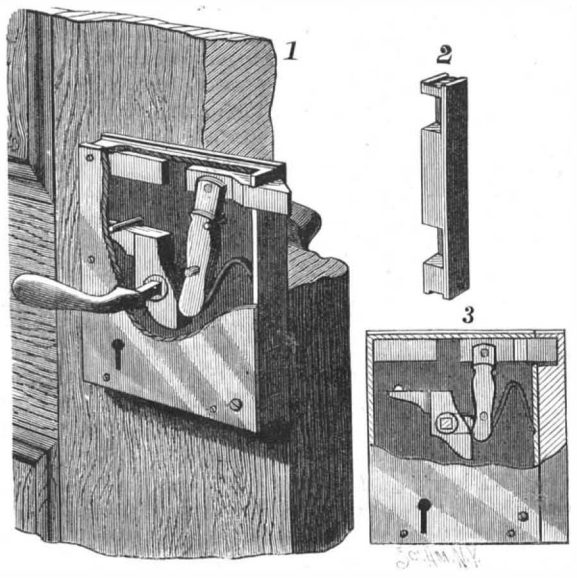
The essential parts of the apparatus are a barometer tube in connection with the exhausted apparatus, and a valve through which air is admitted when, by the action of the pump, pressure becomes reduced below the prescribed point. A copper rod armed with a platinum point passes through the upper end of the barometer tube, and can be adjusted at any desired height. So soon as the mercury rises and touches the point of the rod, an electric circuit is completed and the valve is raised and air admitted. The valve is a glass sphere in a glass seating, the sphere being suspended from the armature of an electro-magnet. The sphere has a weight attached to it, which causes it at once to fall back when the circuit is broken. Even under a pressure of 60 mm. —the lowest obtained with the water pump used—the apparatus renders it possible to maintain the pressure constant to within a millimeter.—*W. H. Perkin, F.R.S.*

For Swollen Feet.

Policemen, mail carriers, and others whose occupation keeps them on their feet a great deal, often are troubled with chafed, sore and blistered feet, especially in extremely hot weather, no matter how comfortably their shoes may fit. A powder is used in the German army for sifting into the shoes and stockings of the foot soldiers, called "Fusstreupulver," and consists of 3 parts salicylic acid, 10 parts starch and 87 parts pulverized soapstone. It keeps the feet dry, prevents chafing and rapidly heals sore spots. Finely pulverized soapstone alone is very good.

AN IMPROVED DOOR LATCH.

A door latch so arranged within an ordinary lock casing that the latch bolt may be easily operated by handles, so placed that the action of pushing down the handle is such as to cause the door at the same time to be pulled open as soon as the latch is disengaged from the keeper, is illustrated herewith, and has been patented by Mr. Latimer S. Shelly, of Steelton, Pa. A dog is mounted on the spindle to which the handles are attached, having an angular projection at one end adapted to bear against a stop pin projecting

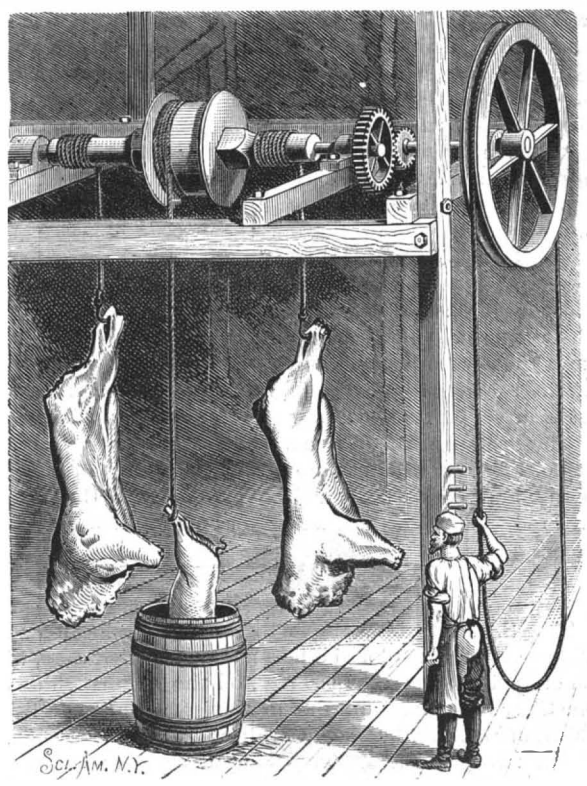


SHELLY'S DOOR LATCH.

from the side of the casing to limit the movement of the dog. The lower end of a lever pivoted to the side of the casing is held to bear against the lower end of the dog by a spring, there being a stop pin secured to the casing which limits the return movement of the lever, to the upper end of which a sliding latch bolt is pivotally connected. Fig. 3 represents a perspective view of the keeper containing the recess for receiving the latch and also one for the regular locking bolt.

AN IMPROVED SLAUGHTER HOUSE HOIST.

A hoist in which the weight of a heavy animal is employed for raising the weight of a lighter animal is illustrated herewith, and has been patented by Mr. Jules H. Tardy, of Glencoe, Minn. It is made with drums of two diameters, the smaller to be usually employed for raising the heavier animals, and the larger for raising the lighter ones, the ropes or chains on the large and small drums being wound oppositely with respect to each other. The windlass shaft is operated by a pinion on another shaft, which carries a grooved



TARDY'S SLAUGHTER HOUSE HOIST.

wheel for receiving an endless rope employed in working the hoist, this rope being held to prevent movement of the load by introducing it between parallel pins projecting from the framework of the hoist. When large and small animals are to be killed, by the using of the larger drum for raising the smaller and the smaller drums for raising the larger, whereby, in the various manipulations, the weight of one animal is made to counterbalance that of the other, the work is rendered lighter and the different operations facilitated.

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Culverts and Bridges.

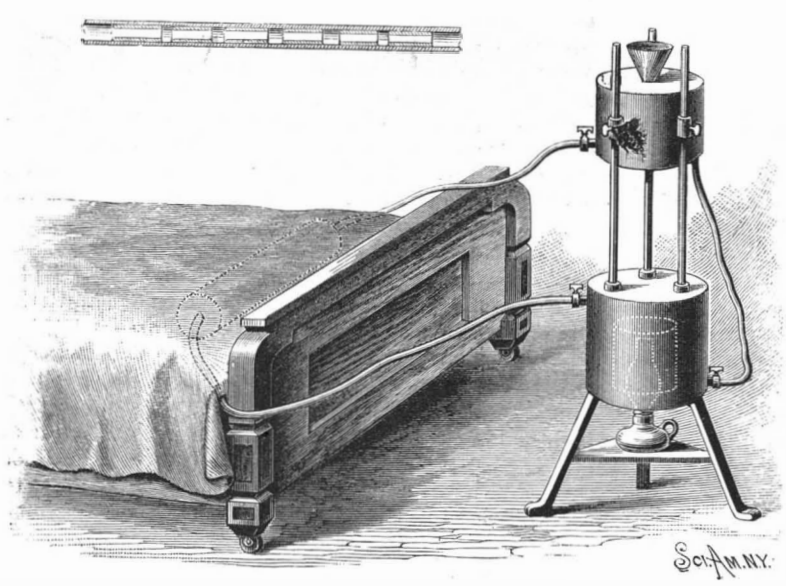
From data furnished by Mr. D. J. Whittemore, chief engineer of the Chicago, Milwaukee & St. Paul system (which had a total length of 5,688 miles on January 1, 1888), the length of open bridges on these lines was 115 91-100 miles, and of culverts covered over with embankment 39 2-10 miles. "Everything," says Mr. Whittemore, "not covered with earth, except cattle guards, be the span 10 or 400 feet, is called a bridge. Everything covered with earth is called a culvert. Wherever we are far removed from suitable quarries, we build a wooden culvert in preference to a pile bridge, if we can get six inches of filling over it. These culverts are built of roughly squared logs, and are large enough to draw an iron pipe through them of sufficient diameter to take care of the water. We do this because we believe we lessen the liability to accident, and that the culvert can be maintained, after decay has begun, much longer than a piled bridge with stringers to carry the track. Had we good quarries along our line, stone would be cheaper. Many thousands of dollars have been spent by this company in building masonry that, after 20 or 25 years, shows such signs of disintegration that we confine masonry work now only to stone that we can procure from certain quarries known to be good."

A Well of Vinegar.

A dispatch from Vincennes, Ind., says: "The mysterious vinegar well which was dug on the farm of S. W. Williams, just east of this city, has been accounted for, after much discussion by chemists and others. Some twenty years ago the farm was owned by F. M. Fay, who had an extensive orchard. The apple crop was large, and he made several hundred barrels of cider, to be converted into vinegar. While the fluid was fermenting, about one hundred barrels burst and their contents were lost. The cider sank into the ground until it reached an impervious strata of clay, where it lay until the well was dug on the same spot."

AN IMPROVED FOOT WARMER FOR BEDS.

A foot-warming apparatus designed to circulate warm water through a chamber or casing disposed at the foot of the bed, and intended to be wrapped with woolen or other cloth, is illustrated herewith, and has been patented by Mr. James A. Lewis, of St. Clairsville, Ohio. Three separate receptacles or liquid tanks are employed —a receiving tank, a heating vessel, and a foot warmer, the receiving tank resting above and supported from the heating vessel by guide clasps embracing vertical rods. From the receiving tank a hose or other suitable flexible conduit passes to the lower part of the heating vessel, from near the top of which a similar conduit passes to one end of the foot warmer, another hose connection passing from its opposite end to the supply tank, whereby a free flow and circulation is secured between the receptacles. If desired, check valves may be employed whereby the heated water will always pass in the direction from the heater to the foot warmer, etc., and be prevented from any return flow. The flexible conduits, near their connections with the foot warmer casing, have short internal re-enforcing tubular sections, as shown in the small figure, so that the pressure of the bed clothing will not prevent or retard the circulation of the heated water. The funnel-shaped outer passage into the receiving tank is closed by a removable ball valve or spherical stopper. It is designed that the lamp by which the water is heated shall have a chimney of metal or opaque material, that the room may not be lighted.

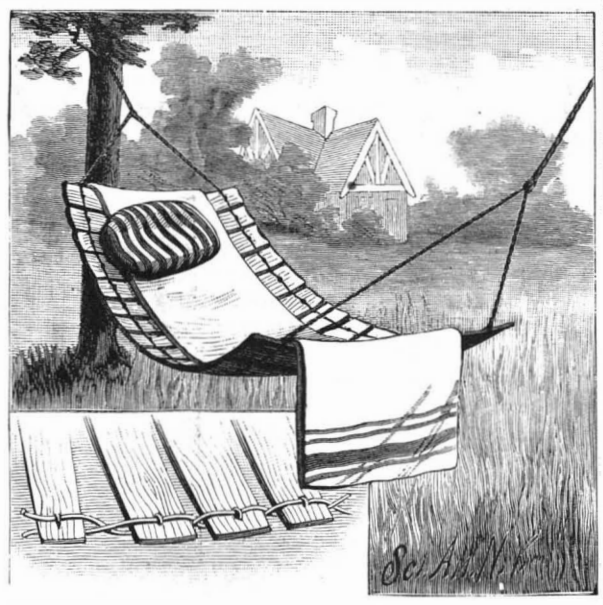


LEWIS' FOOT WARMER FOR BEDS.

Fabric and Fibre mentions an electric picking motion for looms, which is to do away with all the present mechanism called a picking motion. Should this prove true, and there is no reason why it should not, it will cause a revolution, and greatly simplify the loom.

A BARREL STAVE HAMMOCK.

We illustrate in the cut a simple method of constructing a hammock. But little explanation is required, as, owing to the simplicity, the illustration explains itself. The material used includes a number of barrel staves and some rope. The latter should be about one-half inch in diameter. It should be doubled and loosely twisted. Then a second doubling without twisting leaves it in condition for the introduction of the staves.



A BARREL STAVE HAMMOCK.

These are taken from ordinary flour barrels. Two such barrels give material for a good sized hammock. Near each end of each one of the staves a hole about one-quarter inch in diameter is bored. The ends of the staves are then inserted, as shown, in the lays of rope, between the two pieces on each side. The object of the loose twisting is to provide places for the introduction of the ends of the staves. Care must be taken to have enough twists to receive all the staves, and not to have the twisting too tight.

If preferred, the ropes may be twisted as the staves are introduced. This gives a more certain method of securing the desired mean between tight and loose twisting.

To prevent the staves from slipping out, each one is tied in place. A short piece of string is wound at each end of the stave around both ropes, passing through the hole already mentioned, and is then tied. The ends of the suspension ropes are now secured and tied or spliced into loops, and the hammock is complete.

The staves may be used of their original width, or may be split. Probably the most generally satisfactory method is not to split them. The weak point in the construction is the liability of the staves to bend and pull out of place. This, of course, is more liable to happen with split ones, which are of but one-half the normal strength.

When such a hammock is provided with a heavy rug and pillow, it surpasses in comfort the ordinary type. It can be made in a half hour, and we believe that the half hour will generally be considered well spent by the maker. Various other methods of securing the staves may suggest themselves, but the above is given as a simple and effective form.

Lightning Rods.

Some useful particulars are given in Professor Oliver J. Lodge's lectures on the "Protection of Buildings from Lightning," delivered at the Society of Arts. Referring to the tape and rod forms of conductors, it is pointed out that Faraday maintained that sectional area was the one thing necessary, and that shape was wholly indifferent; on the other hand, Sir W. Snow Harris considered that tube conductors were just as good as solid rods, and that flattened ribbon was better still. Faraday was thinking of nothing but conduction for steady currents, Harris was guided by experience. The lecturer thinks that Harris was right, and to prove this point he gives results of experiments made upon two conductors of copper of the same weight, but one in the form of wire, the other in the form of a ribbon, by which it is shown that the flattened form of conductor has the advantage over a mere round section for carrying off a charge, and with least liability to side-flash. As to the deflagration of the conductor, Mr. Preece has found that ribbon and wire are equally easy to be destroyed by a flash. Experiments have also shown that straight conductors have a tendency to side-flash, however thick they may be. No conductor, Professor Lodge says, is able to prevent it altogether, unless it is zigzagged to and fro, in which case it is found to have practically no self-induction, and side spark is nearly stopped.

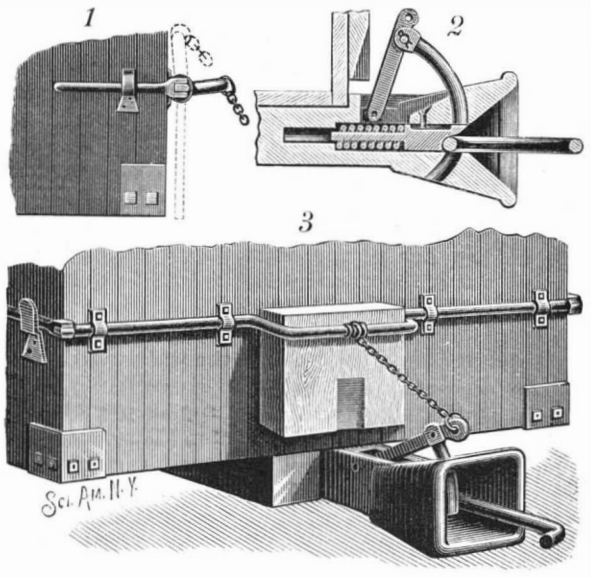
It must also be remembered that a rod of iron carries off a discharge better than a rod of copper. The discharge probably penetrates iron deeper than it does copper. Its inferior conductivity is considered even an advantage in rendering the flash slower and less dangerous. When galvanized, it can be made almost as durable as copper, and its liability to get magnetized is no objection. Prof. Lodge thinks the use of copper for lightning conductors is doomed. The lectures are full of interest for the architect. The liability of objects to be struck is shown to depend upon certain conditions—for example, whether the flash occurs from an already charged surface which has strained the air close to bursting point, or whether the flash is produced by a rush of electricity into a previously uncharged conductor too hastily for it to prepare any chosen path. These are considered, and the results of experiments given.

To Build a Chimney.

To build a chimney that will draw forever and not fill up with soot, you must build it large enough—sixteen inches square; use good brick, and clay instead of lime up to the comb; plaster it inside with clay mixed with salt; for chimney tops use the very best of brick, wet them and lay them in cement mortar. The chimney should not be built tight to beams and rafters; there is where the cracks in your chimneys come, and where most of the fires originate, as the chimney sometimes gets red hot. A chimney built from cellar up is better and less dangerous than one hung on the wall. Don't get your stovepipe hole too close to the ceiling—eighteen inches from it.

AN IMPROVED CAR COUPLING.

A coupling designed to be operated without requiring trainmen to go between the cars, and which permits of cars provided with it being also coupled with those having the ordinary link and pin drawhead, has been patented by Mr. Francis L. McNab, and is illustrated herewith. At the back end of the link socket of the drawhead is a shoulder limiting the inward movement of the link, and behind this socket is a longitudinal recess, prolonged inward by a bore, receiving a trip block and its stem, the latter surrounded by a spiral spring, as shown in Fig. 2. The forward end of the trip block is rabbeted out transversely at its lower part to provide a recess to receive the inner end of the coupling link, which thus rests beneath a tongue or lip of the block, and is held up at its outer end prior to coupling to another car, the lip also serving as a support to the curved coupling pin. The latter is pivotally connected to a pivoted drop bar, whose outer end is connected by a chain to the central cranked part of a shaft journaled across the end of the car body and provided at its outer end with crank arms, hinged to the ends of the shaft, so that when the shaft is turned to lower the coupling pin to couple two cars, the arms may be placed in latch hook supports fixed to the car body, and when lifted or disengaged from the latches the arms will swing down at the side, as shown in dotted lines in Fig. 1, the weight of the pendent arms then being sufficient to hold the coupling up to prevent coupling while shunting the cars, etc.



McNAB'S CAR COUPLING.

For further particulars with reference to this invention address the inventor, or Mr. James Playfair, Sturgeon Bay, Ontario, Canada.

THE Rosedale, an iron ocean-going steamer, has been the first to make the passage between London and Chicago, proceeding up the St. Lawrence and through the ship canal to the lakes. Though a certain amount of her cargo had to be removed to permit her to pass through the St. Lawrence Canal, yet the vessel was still drawing 14 feet on her arrival at Chicago.

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Yellow Fever in Florida.

The United States Marine Hospital Bureau is informed that, about the middle of June, yellow fever reappeared at Plant City, Fla., and there was one death therefrom, June 22. Another case in the vicinity, four miles and a half from Plant City, died on the 26th. There have been several mild cases in the village, which contains less than 300 inhabitants, but for the present trains will not stop at Plant City, and it is understood that mails will be delivered at Cork post office, five miles west of Plant City. In the meantime, by the direction of the Governor, the most active measures are being taken by the president of the county board of health, Dr. J. P. Wall. The board have promulgated the following regulations concerning the epidemic:

"The board of health of Hillsborough County adopts and promulgates the following rules to prevent the spread of yellow fever at and from Plant City:

"1. Railroads passing through or into Plant City are prohibited from carrying passengers and baggage to or from Plant City, or from delivering or taking on freight, or transferring freight from the cars of one road to cars of another road at or near Plant City, except the delivery of the necessary supplies for the people living in the place. Said railroads are also prohibited from delivering or taking on the United States mail at Plant City.

"2. All employes of the railroads living at or near Plant City must be acclimated to yellow fever by a previous attack of the disease, and such employes should be enjoined to keep away from the sick, if any, and aloof from all places suspected, of being infected with yellow fever poison.

"3. These rules are substituted for rule 2 of the rules adopted and promulgated April 24, 1888."

The president of the county board of health states that:

"In explanation of the foregoing stringent rules, it is necessary to say that the board of health of Hillsborough County believes Plant City to be infected with the poison or germs of yellow fever, and inasmuch as expensive efforts to disinfect the place and stamp out the disease have failed, it is due to the public safety and welfare of the State to isolate the place and have it shunned as an infected place until such time as the board of health may deem it safe for people to go there. It is deemed absolutely necessary to suspend all business and cut off all communication with Plant City to prevent the risk of a widespread epidemic of yellow fever this summer. It is true that there is not much sickness there, and happily the large majority of the residents in the place are acclimated by a previous attack of the disease, but by visiting the place or commingling much with the people who still reside in Plant City, there is unquestionably great risk of spreading the disease. The summer is here, and the time for temporizing measures has passed. It is probable that Plant City will remain infected for some time, if not for the whole season, and hence the necessity for these stringent measures."

The Markings on Mars.

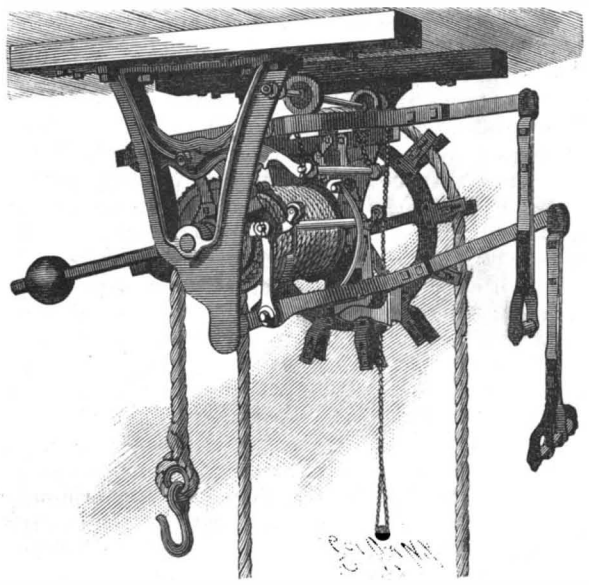
The observations of M. Perrotin at Nice, and M. Terby at Louvain, and, in England, of Mr. Denning at Bristol, have confirmed the presence on the planet of most of the "canals," or narrow dark lines, which were discovered by M. Schiaparelli in 1877, and at subsequent oppositions. M. Perrotin has also been able to detect, in several cases, the gemination or doubling of the canals, and M. Terby has observed the same phenomenon in one or two cases, but with much greater difficulty than in the opposition of 1881–82. But some curious changes of appearance have been noted. An entire district (Schiaparelli's *Lybia*) has been merged in the adjoining "sea," *i. e.*, its color has changed from the reddish hue of the Martial "continents" to the somber tint of the "seas." The district in question is larger than France. To the north of this district a new canal has become visible, and again another new canal has appeared to traverse the white north polar cap, or, according to M. Terby, to divide the true polar cap from a white spot of similar appearance a little to the south of it. With the exception of these changes, the principal markings, both light and dark, are those which former oppositions have rendered familiar.

Resorcin in Diarrhœa.

A case of severe diarrhœa controlled by the administration of resorcin is reported by Mr. G. E. J. Greene (*Lancet*, June 23, p. 1277). The patient was a boy seven years of age, and there was a history of gastric trouble and tormina on the first and second days, for which catechu, opium, chloroform, and chalk had been prescribed without benefit. A ten grain dose of resorcin in half an ounce of water every hour was then ordered, and after the fifth dose the motions were reduced in number, and from having been very offensive were rendered odorless. The dose was afterward raised to fifteen grains every third or fourth hour, and in three days the diarrhœa was completely controlled. No disagreeable after-effects were noticed.

AN IMPROVED HOISTING MACHINE.

A hoist in which an endless rope is employed for operating the hoisting wheel, and the latter is so constructed that the rope will be prevented from slipping, and will also take a hold upon the wheel to assist in hoisting, is illustrated herewith, and has been patented by Mr. Fridrich H. A. Peters, of No. 372 Bronson St., Detroit, Mich. The hoisting wheel has forked arms cast on or secured to its rim, these forks being provided with sliding blocks or jaws, each block having a projection adapted to slide in a slot in the arm of the

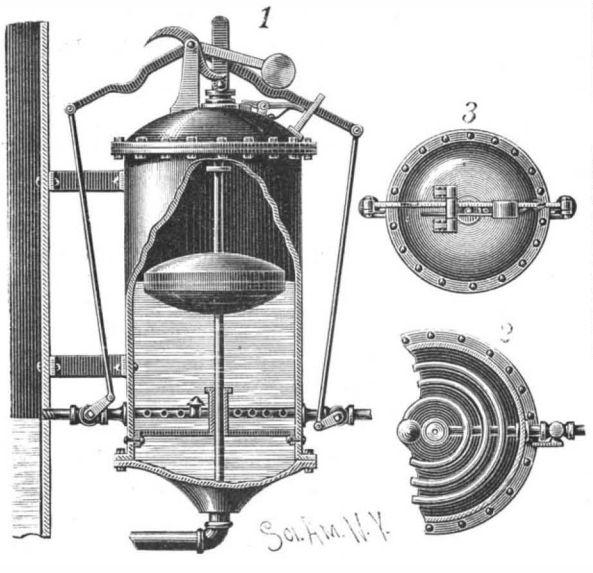


PETERS' HOISTING MACHINE.

fork, and be secured in place by a screw-held plate overlapping the slot. The length of the slot is such as to permit the blocks to slide from the base of the forks to their extremities, and in operation the blocks in the forks at the top of the wheel rest at the bottom of the forks, while at the bottom of the wheel they are at the outer ends of the arms of the forks, the hoisting rope being gradually wedged in between the blocks or jaws in traveling toward the top of the wheel, and as gradually released therefrom in its descent on the other side, the rope being thus automatically clutched and released. The machine is provided with a check cord and pawl and ratchet, for use when it is desired to release the hand hold on the hoisting rope while raising a heavy weight.

AN IMPROVED BOILER FEEDER.

A boiler feeder designed to provide for the automatic maintenance of the water in the boiler at a certain predetermined and required level is illustrated herewith, and has been patented by Mr. John E. Winder, of No. 120 Plum Street, Cincinnati, Ohio. It is made to withstand a steam pressure equal to that of the boiler. Upon a rod mounted vertically therein, and extending out through a stuffing box, is arranged a float, to move up and down upon the rod, between an upper and lower collar. Upon the top of the feeder, as shown in Figs. 1 and 3, is mounted a short shaft, supporting a double-armed lever, the extremities of the arms being connected by rods to crank arms car-



WINDER'S BOILER FEEDER.

ried by the stems of valves, one of which is in the supply pipe and the other in the pipe through which the water passes from the feeder to the boiler, the arrangement being such that when one valve is open the other will be closed. The valve in the pipe leading to the boiler is represented as closed, when, the other valve being open, the water in the feeder will continue to rise, lifting the float against the upper collar on the vertical rod. This rod has a stud bearing against the lower section of an S-shaped arm, connected to a weighted lever carried by the short shaft on top of the feeder, and the vertical movement of the rod by the float carries the arm and its weighted lever upward till the latter passes the center, when the weighted lever will drop upon the other side of the double-armed lever, closing the valve in the water supply pipe and opening the one in the pipe leading from the feeder to the boiler. A spring-pressed vent plug is provided on top of the feeder, for the escape of air from the entering water, and there is a settling chamber at the bottom, tapped by a blow-off, for the removal of impurities. To heat the water in the feeder, prior to its introduction to the boiler, a coil pipe is arranged in connection with the feed pipe, as shown in Fig. 2, the inner end of the pipe being bent upward and surmounted by a cap or housing, the steam thus diffused tending to precipitate any lime in the water. After the feeder has been filled, and the water in the boiler has reached a level lower than the feed pipe, the valves being reversed, steam passes through into the feeder, equalizing the pressure in the feeder and boiler, and putting a supply of hot water into the boiler. When the water in the feeder is lowered till the float rests upon the lower collar of the vertical rod, the other section of the S-shaped lever will be moved to throw the weighted lever upon the other side of the double-armed lever, thus closing the valve leading from the feeder to the boiler and opening that in the water supply pipe.

On the Diameter of the Fixed Stars.

As there appears to be no method known of obtaining the diameter of the fixed stars, the way is open for my suggestion, which I submit for the opinion of practical astronomers. I think I am right in theory, but the difficulties in the way of its accomplishment may be too great. The rays of light which come to us from the fixed stars must be regarded as parallel. The stars have no apparent diameter in consequence of their remoteness. Therefore angular measurement is not possible. We can imagine the existence in space surrounding every star, countless bundles or cylinders of parallel rays of light. Our aim in attempting to measure the diameter of a star must be to find the thickness of one of these bundles or cylinders, which found will obviously correspond with the diameter of the star.

The way I would suggest to do this is to utilize the motion of the earth in its orbit round the sun. A long tube or telescope must be pointed in the direction of the star whose diameter we want to measure, and must be kept parallel by suitable mechanism with its first position. I suppose it would have to be kept in this position for some weeks or months, according to the size of the star, which will very likely be something within the diameter of the earth's orbit, judging from the size of our own sun. If this can be absolutely accurately accomplished, then, when the earth arrives at one certain point in its orbit, the star will leave the field of vision. The point in the earth's orbit where observation commenced, and the direction in relation to some fixed line from earth to sun, must be noted, also the point where the star leaves the field of vision. Then the distance between the parallel lines from the star passing through these two points will be the diameter of the star.—*Capella, English Mechanic.*

Photographing the Sun.

Mr. J. C. O'Loan, of Liverpool, writes: While experimenting with a ray of sunlight in a darkened room, I had my attention directed to pinhole pictures, and am of the opinion that startling results can be obtained in photographs of the sun or moon in this way. In a room darkened by blocking up windows with thick paper, make a small hole in the paper with a "darning needle," so as to admit a ray of direct sunlight. Hold a piece of white paper in the path of the ray, 12 in. from the hole, you will have an image of the sun ⅛ in. in diameter, at 4 ft. an image of ½ in., and at the distance of 8 ft. from hole a 1 in. image, and so on. The size of opening used as lens does not alter the size of image at any given distance, but only its sharpness and brightness. Say the opening is 1-16 in., and gives a sharp picture at 4 ft., by enlarging the opening to one-eighth the size of the image at 4 ft. would be still the same, but unsharp, so that the screen or plate must be removed to twice the distance to obtain equal sharpness. In a room 100 ft. long, a 12 in. picture of the sun could be had, and of the moon one very much larger. A series of pipes 100 yards long for camera would give a 3 foot photograph of the sun. In fact, there is no limit to size of image but the length of camera. Perhaps some one who has more time and space at their disposal than I have may take the subject up.

A CORRESPONDENT of the *Army and Navy Journal* asks: "What is the longest piece of ordnance that has ever been successfully fired?" and receives the following answer: "If you include in the term ordnance everything that carries a projectile, we should answer fourteen miles. This is the straight tube conveying natural gas from Murrayville to Pittsburg. To clear this tube out, a projectile known as the 'gum ball' was inserted in the end at the gas well, closely fitting the interior. The gas was then turned on full force and the gum ball fired through its full length, coming out at the further end in a few minutes."

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Correspondence.

Connecting Telegraph Wires to Water Pipes.

To the Editor of the Scientific American:

During a thunder storm, does enough electricity pass through the ground wire of a telegraph office to make the connecting of said ground wire with a water pipe dangerous to persons drawing water from the pipe?

As an explanation of the above rather ambiguous sentence, I beg to state that in a certain telegraph office the ground wire is attached to the water pipe which supplies the building. Would it be dangerous to touch the pipe during a severe thunder storm?

During a recent storm, in which the lightning was very severe, striking a number of places within one-half mile of the office, reports as loud as those of 22 caliber cartridges appeared to come from a water faucet in the store next the telegraph office, and continued at short intervals during the entire storm.

Glens Falls, N. Y. H. P. BOYD.

[The occurrence you describe suggests an element of danger. In grounding by water or gas pipe, care should be taken that the wire is soldered to a part of the pipe near the water main. The pipe intervening between wire and main could readily give aerial discharges under certain conditions.—ED.]

Keely Outdone.

Several newspapers have referred to a new invention by one William Timmis, which, if successful, will revolutionize motive power. The inventor is an unpretentious English mechanic residing in Pittsburg, Pa., who claims to have invented a machine by which untold motive power can be stored or used without the expenditure of fuel. The story goes that he has been engaged for years in perfecting the invention, and is now negotiating with the governments of England, Russia, and the United States for the sale of the right to use his discovery, which, if after examination it proves to be what he claims, will revolutionize the motive powers of the world. He claims to be able to create a pressure of 20,000 pounds per square inch—more than sufficient to propel the largest ocean steamer afloat or to move eighty laden freight cars in one train.

The machine seems to be simply an air compressor of the simplest sort. It consists of one small cylinder (six horse power), with a balance weight of 75 pounds, which runs the entire apparatus; another small cylinder, 5 inches diameter, with 7 inches stroke, compresses the air into the tank from which the power is utilized. Under the piston plate the inventor has placed two layers of bars containing eleven different minerals, the magnetic influence of which is the secret of the inventor. The advantages he claims are durability, economy, and simplicity. Experts have examined the machine and pronounce it a success.

In submitting his design to the governments named, Mr. Timmis claims that the pneumatic generator can not only be applied to war vessels as a motor, but can be used as a defense against hostile attacks by means of air chambers placed behind the armor plating.

Naval War Balloons.

Captive balloons are to be employed at sea during the next stage of maneuvers by the Toulon evolutionary squadron, under Vice-Admiral Amet. The aerial machines and necessary material will be sent to the fleet from the Army Aerostatic School at Chalais-Meudon, near Paris, where a party of seamen from the Amet squadron, under Flag-Lieutenant Serpette, have been under instruction for ballooning duties for some time past. Preliminary trials with the marine aerial machines are to be made from Toulon harbor, and the balloons and inflating appliances will be subsequently sent to sea on board of a pontoon, in tow of one or other of the vessels belonging to the squadron, and from which the ascents will be effected.

This completes the realization of the picture joke given in our paper of July 21, and the publication of which, in 1801, so frightened the English. In that engraving the French were represented as crossing to Britain with a great fleet, by tunnel under the channel, and also, dreadful to relate, in balloons.

How a Hedgehog Kills a Serpent.

The *Arch. de Pharmacie* of May 5 describes the proceeding as follows: The hedgehog cautiously approached the sleeping reptile and seized the end of his tail between his teeth. Then he rolled himself up into a compact ball and awaited developments. The snake, awakened by the pain, turned upon his enemy and fought with his fangs. The hedgehog, retaining his hold, allowed himself to be dragged back and forth during the struggle, and, meanwhile, the serpent's jaws had become lacerated and useless from constant assaults upon the spines of its enemy. In a few minutes the serpent had become exhausted with his efforts, and the hedgehog, unrolling himself, disemboweled the serpent and ate his meal. In this case the hedgehog does not kill the serpent directly, but obliges him to kill himself by dashing upon the sharp spines.

Precious Aluminous Stones.*

The wonderful fact that the common charcoal is substantially the same material as the diamond has a parallel in the equally wonderful result of the chemical analysis of the ordinary red and yellow clay, so common and abundant, which is shown to have for its base the same material—alumina—as the group of minerals to which the general name of *corundum* is applied, including the incomparable stones, the ruby and the sapphire, which have the highest rank among colored gems. The various forms of corundum are found by the chemist to contain more than half their weight of that peculiar metal widely known as *aluminum*, which much resembles silver in color and luster, yet is very different from it in its extreme lightness The oxide of this metal is called *alumina*, which in its natural state forms the mineral corundum. The transparent crystals of corundum present the alumina in a state of purity, with just a trace of certain metallic oxides, from which the exquisite tints of color are derived.

The name of each variety of the corundum is determined by its color—the red being known as the ruby, the blue as the sapphire, the yellow as yellow sapphire or Oriental topaz, the green as green sapphire or Oriental emerald, and the purple as Oriental amethyst. All varieties of the corundum can be scratched by the diamond, but by no other mineral, and its extreme hardness has suggested the theory that the *adamas* of the early Greek writers was not the true diamond, but a form of corundum. In such a passage as the following, "The sin of Judah is written with a pen of iron and with a point of a diamond," the original word translated "diamond" no doubt refers to *emery* or some similar form of corundum, which has been used for ages as material for polishing other minerals. Although specimens of various colors have been found in many parts of the world, and during the last ten years in North Carolina especially, the chief source of supply is India. The red variety of corundum is known as the ruby.

The kingdom of Burma furnishes the greatest number of rubies, and, by the command of its king no Europeans are ever allowed to visit the mines. They are a royal monopoly, and the rarest and finest specimens are retained for the king's own use, and one of his titles is the "Lord of Rubies." One of the former kings had a wonderful ruby of the size of a pigeon's egg, which he wore as an eardrop. By a law which compels, under the penalty of death, the giving up of all rubies of over a certain size to the financial department of the government, many rubies of large size are lost, because the finder of them will break them up into smaller pieces in order to retain them. Very few persons are aware of the great value and rarity of really fine rubies. From the beginning of civilization to the present time the ruby has been the type of concentrated preciousness: "Her price is above rubies." About fifteen years ago the financial necessities of the Burmese government caused the appearance in Europe of two of the finest rubies of their size ever seen. After being recut one weighed about thirty-two carats, and was sold for $50,000, and the other, weighing about forty carats, found a purchaser at $100,000. Two such stones were not to be found in any European regalia, and their sale caused intense excitement in Burma, a military guard being considered necessary to escort the persons conveying the package to the vessel.

Rubies vary in color from the lightest rose tint to the deepest carmine, and are occasionally approached so closely, both in color and general appearance, by the spinel as to render a close examination necessary to distinguish them apart. The spinel is composed of alumina and magnesia, and has a wide range of color. The Rev. C. W. King states that "all the great historic rubies now extant are pronounced spinels by modern mineralogists."

The blue variety of corundum is known as the sapphire, and differs from the ruby only in its color. It is very slightly harder than the ruby, and occurs in much larger crystals. They were originally obtained from Arabia and Persia, but now come principally from Ceylon and Burma. The characteristic color of the sapphire is a clear blue, very like to that of the blossom of the little "corn flower," and the more velvety its appearance, the greater the value of the stone. The Oriental sapphire retains its exquisite color by gas light, while that of the inferior specimens becomes dark. The ruby and sapphire form a distinct class of the corundums by their being alumina in a pure and unmixed state crystallized, while the other varieties present the alumina in combination with other substances.

The true chrysoberyl is almina combined with glucina. The colors range from light asparagus green, brownish yellow, to columbine red. Of the three varieties, the best known are the cymophane, or true Oriental catseye, and the alexandrite. The catseye is found in Ceylon, is always cut in a highly convex form, and has a remarkable play of light in a certain direction, resembling a drop of water or the pupil of an eye moving about inside of it, or a band of light floating on its surface, ever shifting, like a restless spirit, from side to side as the stone is turned. No wonder that an imaginative and superstitious people regard it with awe and wonder, and, believing it to be the abode of some genie, dedicate it to their gods as a sacred stone. The particular variety of chrysoberyl which was originally found in the Ural Mountains, and owes its celebrity to its remarkable transformation of color from green to red as viewed by natural or artificial light, was named alexandrite after the former Czar of Russia.

* By F. C. Manvel, in the *Christian Union*.

The Causes, Degrees, and Means of Sleep.

The probable causation of sleep is a subject which has often in the history of physiological research attracted the efforts of scientific speculators. It cannot be said that, after all, we are now able to define the processes involved in its restorative influence; but some suggestion of its nature is, nevertheless, within the reach of rational explanation. Most of our readers have, doubtless, formed some opinion on this subject, and have, perhaps, accepted as a provisional creed one or other of the theories advanced with regard to it. To some it may appear that the accumulation of waste products in the brain is enough to account for sleep. Deficient oxygenation offers another tempting hypothesis. Each of these processes, no doubt, may exert a certain soporific power, and probably thus operates in its degree; but it is difficult to see how either can be taken to afford the sole interpretation of that state of rest which comes with singular regularity of recurrence to all more or less, whether sick or healthy, idle or actively employed.

There is something to be said also for the theory that sleep is a consequence of cerebral anæmia. The pathological drowsiness of hemicrania, of epilepsy, and some hysterical states favors this view, as does also the fact that pallor of the fundus of the eye has been noted in connection with natural sleep. These observations do not, however, settle the question whether such anæmia is commonly a cause or merely a part of the general relaxation of energy implied in the soporific process. So far, we can only say of sleep that, following and preceding a period of wakefulness and constant stimulation of the senses, it represents a transient interval of rest from the activities of tissue change. It, therefore, corresponds with the quiescence of every organ, and more especially of the nervous system, and with a timely languor of circulation in the resting tissues. By the gradual changes of evolution it has now virtually become a mere habit of mind and body. At first it was doubtless the outcome of exhaustion and an expression of the well known law, which it still fairly illustrates, that action is balanced by reaction.

The opposite condition of sleeplessness will commonly be found to originate in some continually acting cause of nerve excitement. This may consist in the presence of a local irritation, or very usually in the abnormal irritability of a sensorium overwrought and unduly sensitive to the most trifling impressions. We have already spoken of morbid somnolence in its relation to certain diseases, and have alluded to its connection with a defective cerebral blood supply. We might also refer to instances of an altogether different condition, in which anæmia and sleeplessness are closely associated. This fact is sufficient to show that healthy sleep requires a certain due nutrition of brain tissue, and that cerebral anæmia or hyperæmia has with respect to it only a relative significance. The influence of various toxæmic states must also be remembered in dealing with this subject. Whether due to impairment of function in the lung, liver, or kidney, the only reliable remedy for inconvenience thus caused is, of course, to be found in correcting the failure of excretion. Whatever, indeed, the form of error, be it the want or the excess of sleep, relief by means of so called sleeping draughts and the like is and must be only palliative. The one effectual means of cure in any case is no mere drug, but a method, and consists in the detection and removal of the source of mischief by a well considered system of treatment. —*Lancet.*

The Longest Tangent in the World.

The new Argentine Pacific Railroad from Buenos Ayres to the foot of the Andes has on it what is probably the longest tangent in the world. This is 340 kilometers (211 miles) without a curve. In this distance there is not a single bridge and no opening larger than an ordinary culvert, no cut greater than one meter in depth, and no fill of a height exceeding one meter. There is almost an entire absence of wood on the plain across which the western end of the road is located. This has led to the extensive use of metallic ties, which will be employed on nearly the entire road.

An Improvement in Photographing.

A German photographer, Herr Ottomar Anschultz, has succeeded in preparing photographic plates so sensitive that an exposure of 1-5000 of a second is sufficient. A very small lens must be used, so that the pictures are generally only 7-16 of an inch in length and breadth. Enlarged to an inch and a half on glass plates and rotated in series of twenty-four before a Geissler tube, the pictures are used for reproducing the motions of an animal on a large screen.

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AN EFFICIENT AND ECONOMICAL STEAM LAUNCH.

The great objections, heretofore, to the more general use of small steam yachts and launches have been the difficulty in carrying fuel to run them, coal being principally used, and the cumbersomeness and want of adaptation of the engines, which required a trained engineer to operate the machinery. These difficulties have been largely overcome by the introduction of the Shipman automatic steam engine, using kerosene for fuel, of which we published a description in September, 1884, and an improved form of which, styled the Boston model, is illustrated herewith.

The boilers of these engines are made of wrought iron and steel, tested up to 350 and 400 pounds hydrostatic pressure, and designed to be absolutely safe against either fire or explosion. The fire is formed by steam and oil discharged together in a very fine spray through an atomizer into the fire box, and the supply of kerosene is automatically controlled by the steam pressure in the boiler operating upon a diaphragm, which may be set at any desired limit, so that when the pressure reaches this limit, the supply of oil is entirely cut off until the pressure drops again.

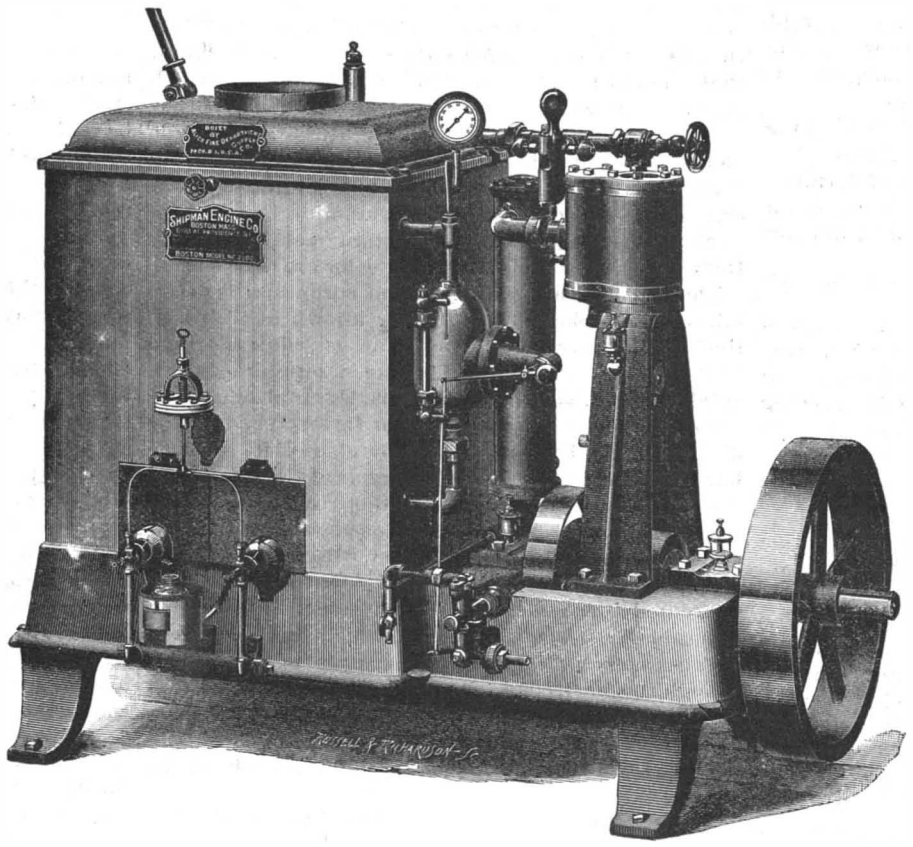
The oil tank is placed at any convenient distance from the fire box, and there is not as much danger in using petroleum, in the way it is supplied by this system, as in its ordinary burning in lamps. The water supply is also automatic, the feed water pump being in operation whenever the engine is in motion, and a ball float connected to the cut-off valve in the pump regulating the supply.

The combustion is as perfect, and ordinarily as free from smoke, as that of a well trimmed lamp. Until steam pressure is obtained in the boiler, an air pump is worked by hand to feed the fire, which never requires more than a few minutes, the fire thereafter taking care of itself, just sufficient oil being then automatically supplied to keep the steam pressure within the limit which has been set. This arrangement secures perfect economy in the use of fuel, as the supply of oil fed to the fire box is always controlled by the amount of steam taken to work the engine, the engine itself putting out its fire when no steam is taken, and relighting it again. The average quantity of oil used per horse power per hour is said to be about two quarts, of a quality equaling 110° to 115° test.

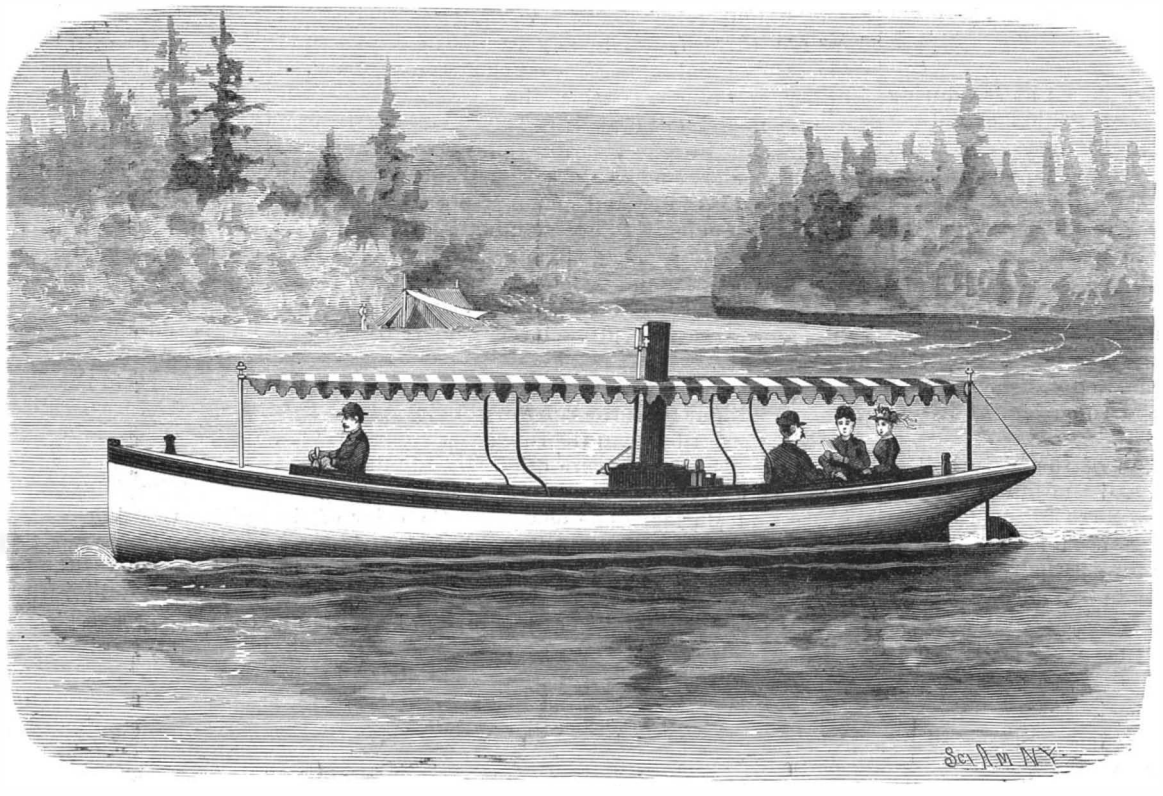
The simplicity of construction and the excellence of material used in this engine, with its automatic water and fuel feed, requiring no attention at any time, admirably adapt it for all uses where it is desired to dispense with the services of a fireman or engineer, while its compact form renders it especially available for use on small steam yachts and pleasure boats.

The Shipman engine, since its first introduction, has been steadily growing in favor for all uses where only a moderate power is required, but it has been an especial favorite as a means of affording power to propel small boats, which has led the company to design and construct a series of launches especially calculated to attain the greatest speed with safety. These launches, of which our illustration shows the design, are made in four different sizes, from 22 to 32 feet long, to be propelled by engines of one horse to six horse power. They have a composition metal propeller, copper oil and water tanks, filter and steam condenser, and all other parts necessary to a complete equipment, and the engine and machinery are fitted to each boat by trained and experienced workmen. The United States supervising inspectors of steam vessels have approved the use of this petroleum engine on vessels, and its use on all government waters is readily allowed.

This engine is popular and efficient for all stationary purposes as well as for marine work. The main office of the Shipman Engine Company is at No. 92 Pearl Street, Boston, Mass., with a New York office at 12 Cortlandt St.



THE SHIPMAN KEROSENE BURNING ENGINE—BOSTON MODEL.



NEW MODEL STEAM LAUNCH FITTED WITH SHIPMAN ENGINE.

Quick-Firing Batteries Charging Infantry.

The part to be taken by quick-firing guns in the war of the future is just now exciting, and quite naturally, much discussion. Military minds differ materially as to the size, weight, and character of the guns, and the methods of using the same; and recently, when Mr. Nordenfeldt, the well known machine gun maker, spoke on the subject before the Royal United Service Institution, he found many to differ with him, some widely, nor may it be said that, even when opportunity offered to answer the objections raised to his conclusions, was he able to clear up the uncertainty as to where quickness of fire should give way to weight of projectile. He cannot see, he says, any advantage in increasing the projectile beyond 8 pounds—his greatest caliber; for then, though you get more effectiveness, there is a recoil that throws the carriage out of position and seriously disturbs the range once got; the gun, too, being heavy and awkward to handle, and requiring the use of a hand spike in the hands of him laying it, while now he may readily follow, while firing, the movement of the enemy's line, and judge from the effect of one shot how he ought to lay the gun for the next. The feeling among artillerists, however, seems to be that the machine gun's caliber should be increased to fire 12 pound projectiles, like the horse artillery arm. As to handling them in the future, it is likely there will be great changes, for now the gunners are protected. In the Franco-Prussian war, where the machine gun, the mitrailleuse, of small bore was used, it was found impractical to attempt to bring up even these quick firers in the face of infantry fire. It is true that at Spicheren two Prussian batteries were advanced to within 800 yards of the French infantry line, but they lost half their men, and would have lost all in a few moments, had not their infantry come up. At Gravelotte, four batteries of the 7th corps advanced up close to the French line, but were almost annihilated. Toward the end of this same battle the French advanced on the Prussian infantry line with a mitrailleuse battery and were actually driving it back, when the field artillery was brought up and checked it. This is a truly remarkable case where an infantry attack was repelled by artillery. Now, however, when machine guns have been improved and provided with shields to guard their gunners, it is thought that such occasions will not be so rare in the future, indeed, that the advance of artillery (a rapid-fire battery) close up upon infantry will be neither impracticable nor uncommon.

The Fire Cracker.

The importation of fire crackers this year will amount to 300,000 boxes, an increase of 100,000 boxes over last year's importation. It is a little curious that the scientific knowledge and inventive genius of this country have proved inadequate for the successful manufacture of these explosives. All attempts to produce them in this country, so as to compete with the imported article, have failed. They are made exclusively in China and Japan, and the importation of last week in June was 14,415 boxes, valued at $34,255. What a large sum to be thrown away on such trash! What annoyance also will be inflicted on a large part of the public, and especially on invalids, when these crackers go off! What risk of calamity, also, for we are reminded that the great fire in Portland—July 4, 1864—was occasioned by a fire cracker. Yes; they are dangerous playthings at the best, and ought to be used, when used at all, with great care. Children, indeed, should not be allowed to fire them, except when under adult observation.—*Mail and Express.*

To all of which we say amen, except as to the impossibility of successfully manufacturing fire crackers in this country; that is to say, if our neighbor lays it to a lack of scientific knowledge or mechanical ability. As a matter of fact, the reason that we import Chinese crackers is that, living as he does upon nothing a day, the Chinaman is enabled to turn out the smaller of the explosives for about two cents a pack—a price against which the American manufacturer and workman find it useless to try to compete. The quality of the wares made here is equal to or better than that of the imported article. Of the larger, or so-called cannon crackers, great numbers are made and sold here, and no one who has ever had one of the wretched, incendiary, murderous nuisances explode anywhere about his feet will deny that in the matter of detonation they accomplish all that the makers could wish.—*Fire and Water.*

A Lightning Flash.

In the *Elektrotechnische Zeitschrift* of March last, W. Kohlrausch has given some estimates of the current and quantity of electricity in a lightning flash. He calculates that it would take 9,200 amperes to melt a copper rod of 2·5 centimeters diameter. Preece's constant—Proc. R. S., March, 1888—makes it 10,244. Such a current concentrated in a flash would contain from 52 to 270 coulombs, which would decompose from 5 to 25 milligrammes of water and from 9 to 47 cubic centimeters of explosive gas. If this energy were stored up and distributed for electric lighting, it would require from 7 to 35 such flashes to keep one incandescent lamp alight for an hour.

ONE of the new applications of a waste product to a useful purpose is the manufacture of paper out of cedar wood pulp, for underlaying carpets, wrapping of wool, furs, etc. The paper makers procure the cedar chips of pencil manufacturers, and the paper made of this material will, it is claimed, preserve articles wrapped in it from the moths.

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VIBRATORY MOTIONS OF RAILS DURING THE RUNNING OF TRAINS.

At the inception of railways, the manner in which tracks should be laid was determined by somewhat theoretical calculations of resistance, which since that epoch have been considered as sufficient in practice, and have been preserved without any very important modifications. The sole changes that they have undergone, moreover, are due, in most cases, to the personal estimates of engineers, rather than to the result of very accurate observations. The only experiments attempted up to the present to ascertain the stability of tracks have been made, in fact, with immovable loads, and are insufficient to permit of accurately ascertaining the state of the track, during the passage of a train, under the influence of instantaneously developed reactions of all natures, such as flexion, lateral thrust of the rails, and inclination of the ties. It is these stresses and displacements, which are infinitely small as regards duration and amplitude, and which, moreover, vary from one instant to another of the train's running, that it is important to observe and to seize in their ephemeral existence; for, although they disappear immediately, it is only to reappear a short time afterward under slightly different conditions during the passage of the succeeding train, and it is their ever repeated action that wears the track and produces permanent distortions in it. They, therefore, lead to considerable expense in the way of keeping the road in repair, and may, at a given moment, be the cause of most serious accidents.

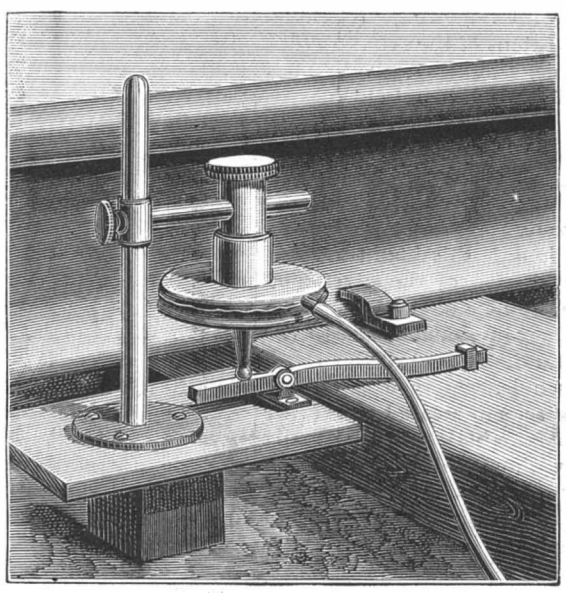

Fig. 1.—APPARATUS FOR MEASURING THE VERTICAL DISPLACEMENTS OF TIES.

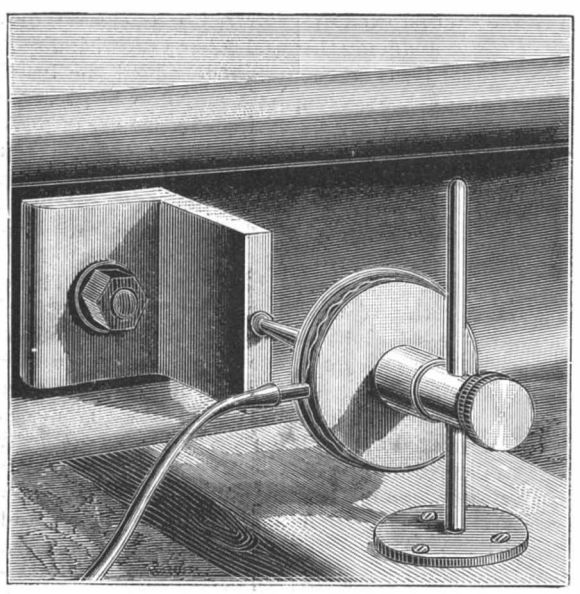

Fig. 2.—APPARATUS FOR MEASURING THE LATERAL DISPLACEMENT OF RAIL HEADS.

We have here one of the most difficult subjects of research, but one which is capable of giving most interesting results, by showing the points that are most strained, the nature and extent of the distortions, and the precautions to be taken to avoid them in the laying of the track, by supporting it in the weakest places, etc.

One of the most distinguished engineers of the Lyons Company, Mr. Couard, the inventor of an ingenious signal, has not hesitated to undertake this study (which he has now pursued for five years), and has endeavored to register those continuous phenomena, such as oscillations and vibrations of every nature, that moving trains give rise to. For inscription, the graphic method was clearly indicated, and as for apparatus of observation, Mr. Couard found these in the ones that were already in use in physiological studies for the inscription of analogous vibratory motions. Messrs. Frank & Marey's sphygmograph, which is used by physiologists in the study of the motions of birds' wings, etc., has been adapted likewise by Mr. Couard to the study of the motions of the elements of the railway, of which, so to speak, it was a question of feeling the pulse. The preliminary researches were made in 1883, with instruments lent by Mr. Marey, and led the Lyons Company to decide on the construction of analogous apparatus especially adapted for the study of tracks.

The apparatus thus arranged by Mr. Couard comprises an explorer of small bulk, placed upon the rail to be studied, and all the motions of which are transmitted to an inscribing device placed at a sufficient distance from the track to be uninfluenced by disturbing vibratory motions. The transmitting part is a simple rubber tube inclosing compressed air, and it is the variations in pressure caused by the displacements of the explorer that act upon the inscribing apparatus. We have here, as may be seen, the principle laid down in 1860 by Mr. Buisson, who applied it with success to the sphygmograph.

The explorer, which is represented in place in Figs. 1, 2, and 3, is a sort of bellows consisting of a small, round metallic box, closed by a sheet of rubber, to the center of which is fixed a rod whose rounded head bears against the rail. A spiral spring fixed to the bottom of the box repels the rubber and prevents the box from flattening without external stress. In the bottom there is a small tubulure, to which is fixed the rubber tubing running to the receiver. This latter consists of a bellows analogous to that of the explorer, but the rubber of which supports a goose quill style as light as possible that inscribes the displacements upon a cylinder covered with lamp black.

Fig. 3, which gives the general arrangement, shows four receiving apparatus mounted in front of the same registering cylinder, which might take the inscriptions of each of them at once, but only one is actuated by the tube of the explorer put in place. The blackened cylinder that constitutes the registering apparatus is driven by a clockwork movement, the uniformity of whose running is assured by a Foucault pendulum. It may be given three different velocities through appropriate gearings, or be stopped instantaneously. The inscription is taken upon the blackened paper that covers the metallic cylinder, and is afterward fixed through immersion in photographic varnish. It is then used for taking copies to serve for studying the traces obtained.

As it is very important to control the regularity of the cylinder's motion, for the exact determination of the speed of the trains, Mr. Couard has completed his apparatus to this effect by a tuning fork, whose motion is kept up by an electric current, and the intersections are noted graphically by Deprez's electro-magnetic signal.

In this way Mr. Couard has noted interruptions amounting to 100 per second, but the apparatus is so sensitive that, according to Mr. Marey, it is capable of inscribing 1,000 and even 1,200 vibrations per second.

Other apparatus that it would take too long to describe here serve for determining the precise instant of the passage of the forward axle of the train. Figs. 1, 2, and 3 show the arrangement of the explorer on the track according to the nature of the motion to be studied. That in Fig. 1 serves for taking the vertical displacements of the tie. The apparatus, as may be seen, rests upon a board fixed to a block partially buried in the earth between two ties. The board supports the axis of a lever, one arm of which is attached at the extremity to the tie to be studied, and the vertical motions of which it undergoes. The button of the explorer rod rests upon the other arm and transmits the latter's oscillations to the rubber. This arrangement permits of varying at will the respective lengths of the two lever arms and to reduce the inscriptions when the amplitude of the motions of the tie displaces that of the oscillations of the explorer.

For measuring the lateral overset of a rail on a tie, the explorers are placed externally to the track with the rod horizontal, as shown in Fig. 2, and the button bears with a certain pressure against the extremity of an angle iron bolted to the web of the rail, and is held by a wire in order to assure of an interdependence of the two motions. Under such circumstances, the horizontal displacements of the explorer are equal to half of those of the head of the rail, the angle iron being fixed at the center of the rail. It, therefore, suffices to double the indications of the explorer to ascertain the amplitude of the displacements of the rail head, for it has been found that the foot does not slide upon the tie.

Fig. 3 shows the arrangement adopted for measuring the vertical flexions of the rail independently of those of the tie. The explorer rests upon a lever supported by a horizontal board, which rests upon two straps attached to the rail by a bolt. A spring formed of a rubber band keeps the lever arm continually in contact with the button of the explorer.

With the apparatus just described, Mr. Couard has obtained most interesting data, that permit of most completely analyzing the complex motions of rails.—*La Nature.*

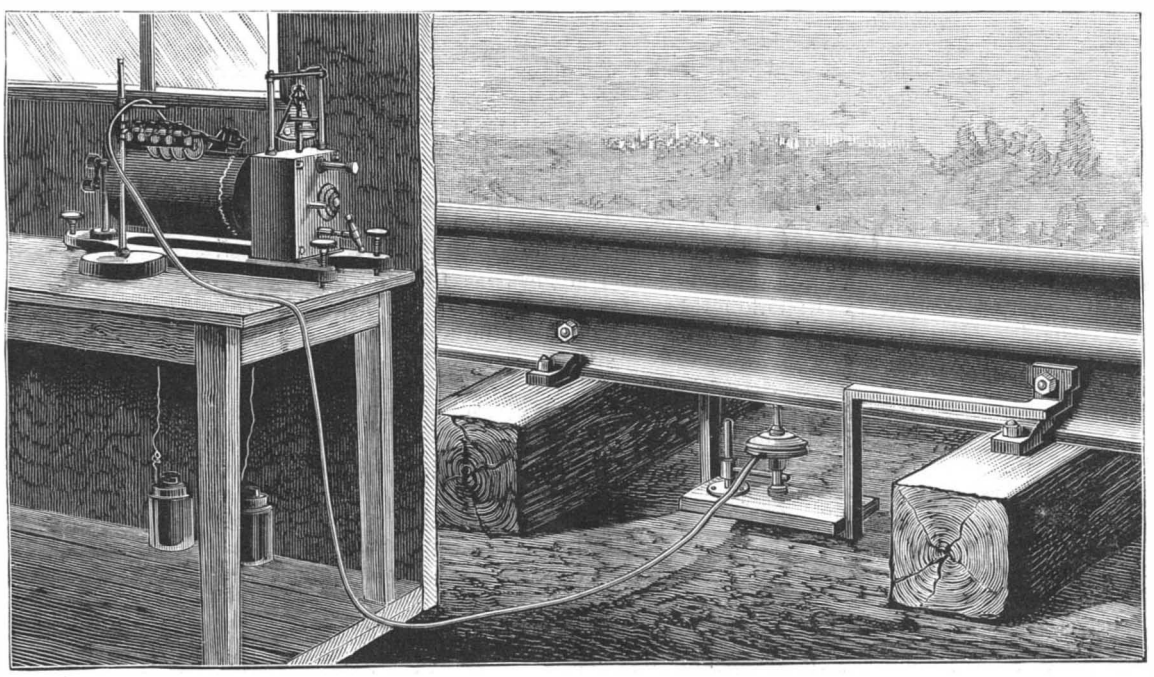

Fig. 3.—APPARATUS FOR MEASURING THE VERTICAL FLEXIONS OF RAILS.

Rivers vs. Railroads.

The authorities of New South Wales, where all the railroads in the colony are owned by the government, are greatly troubled by steamboat competition on the Murray River. The people on the banks of the river induced the government to build a railroad to take out their produce, and also to expend £200,000 in dredging the Murray. The steamboats then cut under the railroad, which put its freight rate down so as for a short time to take all the traffic, but the steamboats have more than met that cut, leaving the road nothing but the passenger traffic, which does not pay. As the roads were built to develop the country, it seems hard to the government that they should be called on to operate them at a loss, and it is proposed to put a river toll on the steamers that shall be heavy enough to restore the traffic to the government road. But this plan is open to the charge that the consequent increase in transportation rates would deprive the inhabitants of the Bourke district of the natural advantage of living on a watercourse, arresting the development due to cheap transportation, and would sink the £200,000 expended for dredging. On the other hand, it may be claimed that all other districts in New South Wales should have as cheap transportation as the Bourke district; but this might involve not only the payment of interest by the imposition of direct taxes, but a part of the operating expenses as well. The *Railroad Gazette*, looking at this matter from a distance, says: "The instance presents a curious study of the complications which may beset government control of railroads where watercourses afford opportunities for competition."

A SWISS engineer has proposed a scheme for supplying Paris with water from Lake Neufchatel, at an estimated cost of 20,000,000*l*. The aqueduct required would be 312 miles long, 22 miles of which would be a tunnel through the Jura Mountains. As the lake is 1,620 feet above the average level of the streets of Paris, the scheme includes a plan for using the surplus head to furnish power.

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Improved Photographic Plates.

A considerable time has now elapsed since the promulgation of the discovery that, by the addition of certain dye stuff to the sensitized silver compound, a different range of sensitiveness is obtained to the various colors of the spectrum, whether in their native purity or as they are represented in the colors of natural objects which it may be desired to represent by photography; and that this range may be made to correspond far more closely with the effect of luminosity which such colors produce, through the eye, upon the mind of the spectator, than that given by the silver salts themselves without such addition.

It may, at first sight, appear surprising to many, considering how many years this idea has been before the public, and how much attention has been bestowed upon its development by leading scientific men among the photographic experimentalists in various parts of the world, that the advantage which such an approximation to a more truthful representation gives—enabling us to meet, so far as it goes, the greatest reproach which has been brought against photography—should not have been by this time so fully appreciated as to insure its almost universal adoption. As very commonly happens, several causes were at work tending to delay the general use of an improvement which may now be considered to be established as such. One of these causes was doubtless the fact that photographers had been led to expect results of a somewhat similar character from the substitution of bromide for bromo-iodide of silver, when the gelatine process came to take the place that had been previously occupied by collodion, and had found that practically there was no difference in the power of rendering colored subjects when used in the camera in the ordinary way for the reproduction of natural colors.

This disappointment naturally engendered among those who make photography their business a certain amount of disbelief and unreadiness to venture upon further trials in the same direction.

Another serious drawback was found in the fact that the earlier prepared orthochromatized plates commonly gave a somewhat veiled image, deficient in the brightness and pluck so necessary for successful commercial work. Yet a third drawback—and perhaps the most important one—was that, with orthochromatized gelatine plates as at first prepared, it was necessary, in order to obtain any very decided effect when photographing natural objects of the ordinary kind, to employed a colored screen, which at the same time introduced certain optical difficulties, and necessitated a considerably prolonged exposure. All these considerations militated seriously against the general adoption of orthochromatized plates for the ordinary work of the studio and the field, although the undoubted advantage of the principle of color sensitizing caused it to be more and more taken up, when a truer representation of the effect of various colors was most required, and when, as in the case particularly of copying paintings and other works of art, the disadvantage of prolonged exposure due to the use of the color screen was not serious.

The undue prominence of action by objects of certain colors, violet and blue, and the corresponding insufficiency of photographic energy displayed by others, green and yellow particularly, as evidenced by the want of lightness and life in the foliage of landscape photographing, and the excessive prominence given to freckles and to yellowish discolorations of the skin in portraiture, have steadily been kept in mind by scientific photographers, who have strenuously endeavored by research and experiment to remove this stigma upon photography, as well as by those whose bent is more in the artistic direction, and who recognize only too strongly the evils referred to, and are ready to hail with delight a remedy for or palliation of it, if only it can be shown that the remedy is a real one, and within the range of practical application.

Some landscape photographs which we have seen recently, and which we were given to understand had been produced without the interposition of a colored screen, upon plates prepared after a formula by Dr. H. Vogel, lead us to believe that the time is not far distant when a much more extended use of orthochromatized plates will be made than has been the case up to the present time. In landscape work generally the tendency is for trees and bushes to come too dark and heavy, relieved principally by the light reflected in a glistening manner by some of the leaves which happen to be at such an angle as to reflect the light from their surfaces. In the examples we have referred to, clumps of bushes and other foliage came out without excessive glitter, and with a beautiful light extending over the greater part of the objects, contrasting, as we see it in nature and in good paintings, with the bold, decided shadows of the stems and base; altogether giving that roundness to the object, as a whole, which is a beauty so much to be desired in the foliage of landscapes in a general way, and indeed which was in marked contrast with some other photographs of the same scenes, taken, as we understand, under similar conditions, with the exception that in the latter case ordinary unorthochromatized gelatine plates were employed.

In the studio, too, the employment of orthochromatized plates should, besides the better rendering of draperies, tend to reduce the necessity for retouching. There is no doubt that retouching, while an admitted necessity for those who have to make a business out of photographic portraiture, has, in many cases, been made to act as a substitute for good, sound photography, and so has been the cause of stagnation, or even deterioration, in the quality of the work produced. Retouching has been made a necessity, partly from the love of the sitter to be flattered, but partly also from the need for correcting the faults of photography itself. One of the faults, excessive blackness of the shadows, may be very much remedied by careful lighting and exposure. Another fault, that which has been referred to as the too powerful rendering of freckles and other yellowish discolorations of the skin, to which might be added the insufficient lightness given to fair hair, may now be greatly alleviated, if not entirely removed, by the use of plates having a different range of sensitiveness and color from that possessed by the haloid salts of silver alone. There is then a prospect of real improvement in photography, which we trust will stimulate our readers to do their utmost to help on the accomplishment of this long felt desideratum.

One thing more. The sensitizing of the silver compound for those rays which produce too little effect on the plate in proportion to their luminous power to the eye should—and we understand, does—exalt the sensitiveness of the plate as a whole. So then, instead of having to do with an exposure of increased length, we may, when using orthochromatic plates that are really effective when employed without a colored screen, expect to find that we are enabled to still further shorten the exposure, and so a gain all round should result.—*Photographic News.*

[SCIENCE.]

An Army of Worms.

I am in receipt of a letter, bearing the date July 6, 1888, from Mr. W. H. Cleaver, East Bethlehem, Pa., in which he states that the worms, specimens of which he sends, are at the present time very abundant in his neighborhood.

To quote from the letter, "They are traveling eastward in countless millions. They travel at night or in the cool of the morning and evening. They camp during the day by getting under sods, boards, stones, or anything to protect them from the heat of the sun. In some places during the day they are piled up in great numbers. They do not seem to destroy anything on their journey, but go harmlessly along. Fowls will not eat them, and birds do not appear to molest them."

The specimens which accompany the letter are, I think, the common *Polydesmus erythropygus.* In the absence of any complete systematic work on the *Myriopoda*, I am not able to identify the species with absolute certainty. The species is very common in this vicinity, but I have never before heard of its occurrence in such numbers as reported by Mr. Cleaver.

EDWIN LINTON.

Washington and Jefferson College,
Washington, Pa., July 7.

The Lick Observatory.

It is announced that Professor S. W. Burnham, of Chicago, well known as an efficient astronomer and amateur photographer, has been appointed on the staff of the Lick Observatory.

On the occasion of his departure from Chicago, where he has resided for some time, he was honored with a farewell dinner by a few of his numerous friends and co-workers in the art-science of photography. Among those present were Professor George W. Hough, of Dearborn Observatory, Rev. Dr. Arthur Edwards, Dr. H. D. Garrison, G. A. Douglass, Judge Bradwell, H. L. Tolman, C. Gentile, W. A. Morse, Dr. C. G. Fowler, Col. A. F. Stevenson, Professor Basten, and Lieut. Schwatka, the Arctic explorer.

The Pacific coast may well be proud in having obtained the services of Professor Burnham for the world famed Lick Observatory, while Chicago loses in him a noble friend of the sciences.

A Cheap Ice Chest.

Take two dry goods boxes, one of which is enough smaller than the other to leave a space of about three inches all around when it is placed inside. Fill the space between the two with sawdust packed closely, and cover with a heavy lid made to fit neatly inside the larger box. Insert a small pipe in the bottom of the chest to carry off the water from the melting ice, and you have a very cheap and tolerably effective ice box for family or grocers' use.

A Stopper for Rats.

A correspondent says: Soak one or more newspapers, knead them into a pulp, dip the pulp in a suitable solution of oxalic acid. While wet, force the pulp into any crevice or hole made by mice or rats. Result—a disgusted retreat, with sore snouts and feet, on the part of the would-be intruders.

THE EDISON PHONOGRAPH IN ENGLAND.

The phonograph, which has nothing to do either with the telephone or the telegraph means of instantaeous communication, is a wonderful instrument for preserving, and for repeating in any place, from a permanent acoustic record, the tones, accents, and articulate syllables uttered by the human voice, perfect discourse in its original pronunciation, as well as every kind of musical and other sounds, after conveyance of the inscribed record, by ordinary carriage, to within hearing of a future auditor. Professor Edison, of Orange, N. J., in the United States of America, renowned for his improvements of the electric light apparatus and other most valuable scientific contrivances, is the inventor of the phonograph, a rudimentary form of which, exhibited in London ten years ago, then excited much public curiosity. He has, during the past twelvemonth, brought it to a degree of comparative perfection, which was practically tested, on June 25, by experiments at the house of Colonel G. E. Gouraud, the agent in London for Mr. Edison's inventions, residing at Little Menlo, Beulah Hill, Upper Norwood; and on June 29, in the press gallery at the Handel festival, in the Crystal Palace. Our illustrations represent the scenes on these two occasions; in the first instance, a private family party at Norwood listening to the tones and words of Mr. Edison's voice, ten days after he had spoken in America, at a distance of nearly three thousand miles--the "phonogram" having been sent from New York on June 16, with the regular United States mail, by the German Lloyd's steamship Eider, to Southampton; in the other case, during the grand performance of Handel's music, the phonograph reporting with perfect accuracy the sublime strains, vocal and instrumental, of the "Israel in Egypt," received by a large horn projecting over the balustrade in the vast concert room in the north transept of the Crystal Palace. The machine was worked by Mr. De Courcy Hamilton, one of Mr. Edison's assistants, who had brought it from America. The "phonograms" being sent to Mr. Edison, all the Handel choruses, as sung here by four thousand voices, with the orchestral and organ accompaniments, will be heard in New York and in other American cities. They can be repeated to a hundred different audiences for years to come.

We can only give a brief account of the essential parts of the phonograph. There is a disk of bright metal, rather larger than a shilling piece, so poised as to vibrate in correspondence with any sound that is received by the instrument. Below, and attached to this disk, is a minute point of metal, like a fine pin, which, as the diaphragm or disk vibrates, cuts an exceedingly delicate, sinuous, hair-like line into a revolving cylinder of wax. When the record is once engraved on the cylinder, we can, by reversing the movement, get back from the instrument the sounds that were put into it. In the phonograph first exhibited in this country ten years ago, which was illustrated in this journal on August 3, 1878, the sound marks were made, in a similar manner, on tin foil; and their tone was metallic, nasal—sometimes a squeak, indeed—very often ludicrous or miserable; but Mr. Edison has now constructed a phonograph which, by substituting a composition of wax for the tin foil, and by other important contrivances, has entirely got rid of any harshness or weakness of tone.

In external appearance, Mr. Edison's wax cylinders are like ivory napkin or serviette rings, only rather larger, and about three inches long. They fit on a small iron rod, which is put in rapid motion when wanted by a little bichromate galvanic battery, seen in our illustration under the table. When Mr. Edison, in the earlier period of his experiments, desired to use one of the cylinders over again for new matter, much time was wasted in passing it through the apparatus. He now arranges a minute knife upon the same arm which bears the diaphragm stylus. The knife cuts off a shaving, and the diaphragm stylus follows in its wake; both operations being accomplished at once. Wax cylinders are made thick enough to allow the indented surface to be planed off twenty times or more, so the same cylinder can be used for as many different transcriptions. Another new device perfects the method of duplicating phonograms containing matter which may be worth selling, such as books, music, sermons, speeches, or plays. When a phonogram of special interest or value is obtained, which it is desired to multiply, it is coated electrically with nickel until a thick plate is obtained. This plate, when detached from the wax and pressed against a fresh sheet of warm wax, gives an exact reproduction of the original phonogram; and such duplicates may be made so easily and rapidly as to cost scarcely anything. To obtain the first phonogram of the book or of a piece of music may require care and special skill. Once obtained, a million can be made from this one nickel mould. So far as countless experiments in the laboratory show, there is no perceptible or audible wear in the wax phonogram, no matter how frequently it is made to repeat a message.

If Colonel Gouraud wants to phonograph a dispatch to New York, he talks into the mouthpiece, the cylinder is turned round by the electric current, the repeating disk vibrates in harmony with the voice, and the

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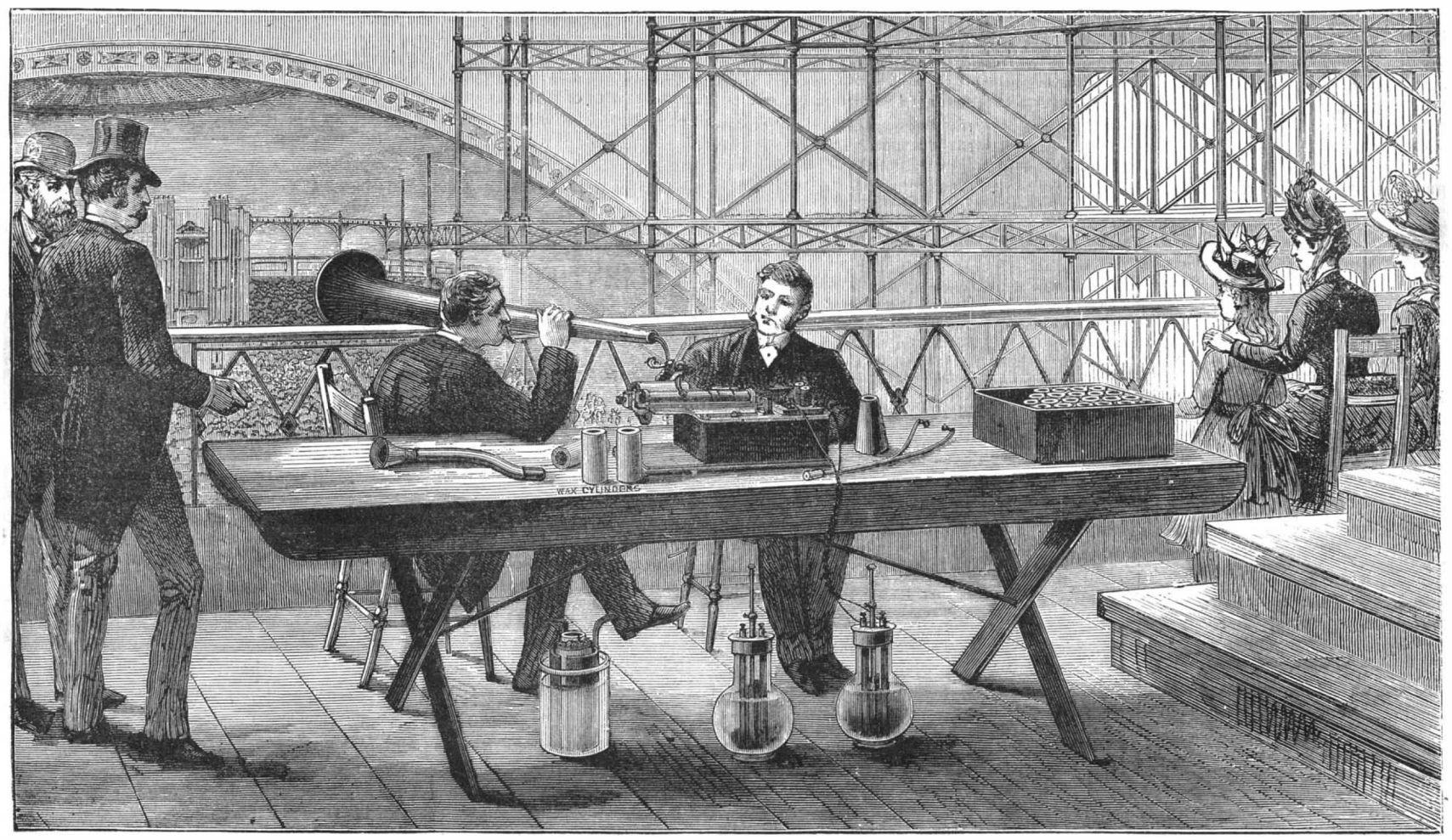
minute point below traces on the wax surface of the cylinder its invisible curves, and that is all. The message is done, you can now take it off and post it —at the ordinary letter rate—to America. In those four inches he has a thousand words, which would be a very long letter. Probably he does not wish to send more than 250 words. If so, a corresponding length can be cut off and dispatched by post. The phonogram produced would in New York be placed on a corresponding machine, and exactly reproduced. We have a copy of the first phonogram, which was a private letter from Mr. Edison to Colonel Gouraud, consisting of about two hundred words, treating of business and family affairs. Mr. Edison's voice was recognized by every hearer in Colonel Gouraud's house, including a child seven years old. Several pieces of music, vocal solos and duets, and performances on the pianoforte, cornet, and other instruments, sung or played in America, have been repeated in England by the phonograph. A poetical ode, of four verses, dictated by the Rev. Horatio Nelson Powers, D.D., of Piermont on the Hudson, has also been spoken, in the author's own voice, through this marvelous machine.

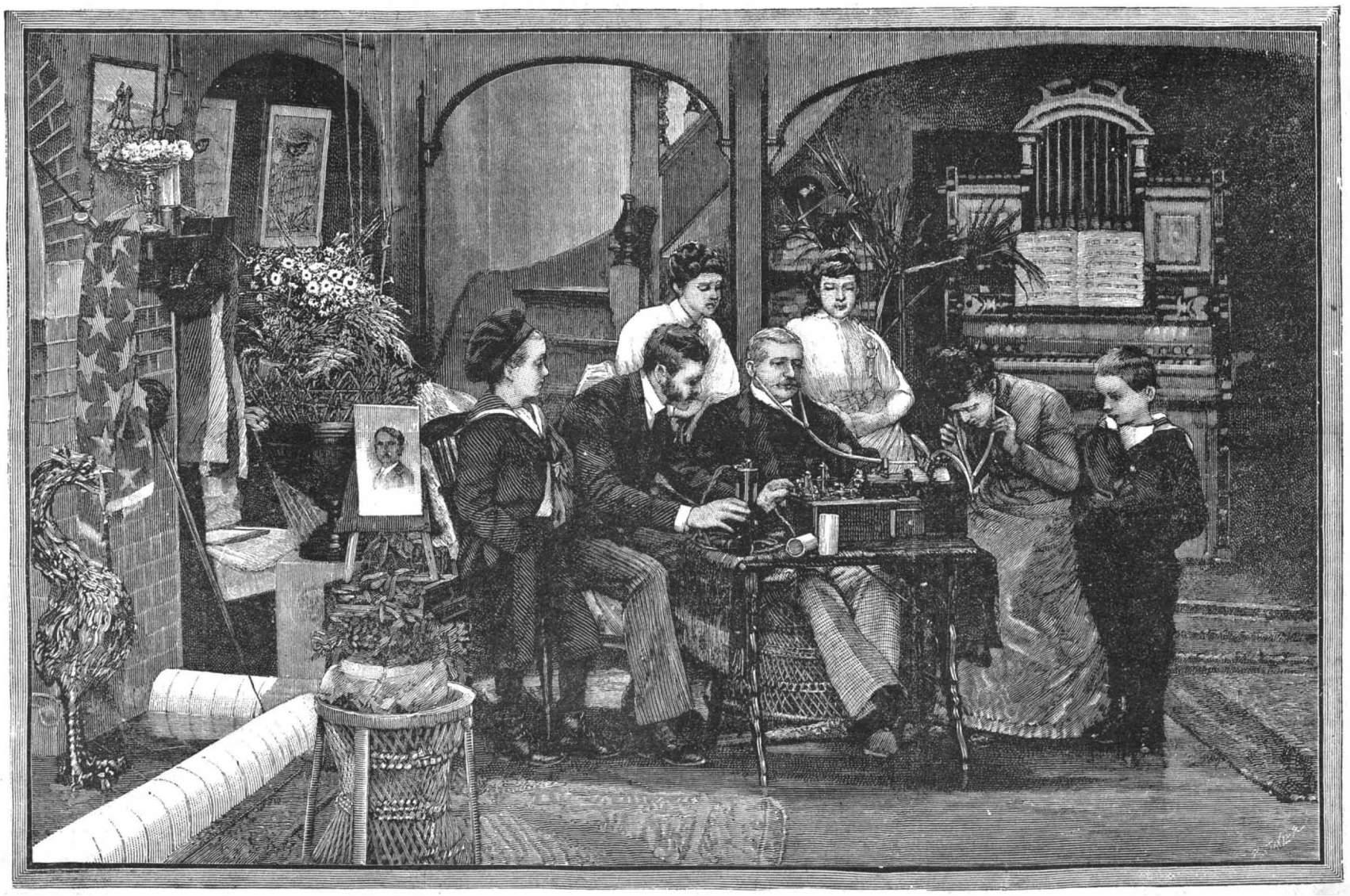
Many of the most important parts of the phonograph are concealed in a small metal-covered box, but as Mr. Edison has expressed a wish for the present to keep secret the details as to some new points in the construction of the phonograph until his patents have been obtained, we therefore omit further description of its interior workings.—*The Illustrated London News.*

[In the United States, the Edison and Tainter patents on the phonograph have been purchased by the North American Phonograph Company, of New York, and the corporation expect to make of it the strongest sort of a monopoly. They have fixed the capital stock, as a starter, at the modest sum of $6,600,000, and will doubtless increase the amount, if the invention succeeds as well as they expect. The company proposes to follow the footsteps of the Bell Telephone Company in scooping in money. That is to say, the phonographs will be rented, not sold, the rental each year being say $40, or say five times more than the first cost of the instrument.—ED.]



EDISON'S PERFECTED PHONOGRAPH IN ENGLAND—EXHIBITION AT THE CRYSTAL PALACE.

M. H. WUILLEUMIER has recently made a redetermination of the true value of the ohm, using Lippmann's method. He concludes from his experiments that its value is the resistance of a column of mercury of a square millimeter section, 106·27 centimeters long, this result being practically the same as that obtained by Lord Rayleigh and others.



RECEIVING A MESSAGE FROM AMERICA BY EDISON'S PHONOGRAPH.

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ENGINEERING INVENTIONS.

A locomotive fire box has been patented by Mr. Charles W. Hullings, of Burlington, N. J. An arched and detachable hollow baffler extends through the upper end of the fuel opening into the fire box, the interior of the baffler connected with the water section of the boiler, while it is of a shape designed to prevent cold air entering from striking the crown sheet.

A stove for heating railway cars has been patented by Mr. Edwin W. Luce, of Bolivar, N. Y. The fire pot of the stove is inclosed by a metal casing, a portion of which consists of a suspended drop section, which, in case of accident, is released, and drops to close the stove and prevent all escape of fire, even if the stove be upset or turned wholly upside down.

A gas engine speed regulator has been patented by Mr. John Bradley, of Philadelphia, Pa. This invention covers a novel construction and arrangement of parts in a device to be connected with the gas supply valve, whereby the supply of gas may be decreased to almost stop the engine when the power is not being used, but with which the engine may be enabled to gain full speed in less than half a minute.

AGRICULTURAL INVENTIONS.

A potato planter has been patented by Mr. John H. Priestley, of Meriden, Iowa. It has a hopper-shaped seed box with downward projections and spouts, in connection with a coverer and marking bar, and other novel features, whereby potatoes may be planted rapidly, economically, and evenly, in straight rows.

A weed cutter has been patented by Mr. Gustavus Hauschild, of Topeka, Kansas. It is intended for use as an attachment to cultivators, as a substitute for some or all of the cultivator blades, to throw the weeds to or from growing plants, and cut them off above, at, or below the ground surface, also stirring the ground close to the plants.

MISCELLANEOUS INVENTIONS.

A match making machine has been patented by Mr. Karl Peukert, of Durlach, Baden, Germany. It is for laying out the finished matches out of the dipping frames, placing the matches close together in good order with the heads all in one direction, and thus substituting machine for manual labor.

A combination pocket tool has been patented by Mr. William R. Buzzell, of Shelburne, Mass. The invention consists in a hollow handle provided with a tool-receiving socket, and having a pivoted cover adapted to hold the tools in the socket, and to confine them in the hollow of the handle.

A thread unwinder for sewing machines has been patented by Mr. Albert J. Hart, of Brooklyn, N. Y. This invention provides a novel spool frame, provided with a flier, so that the thread may be drawn off from the spool without revolving on a stud or spindle, whereby large spools may be used with any sewing machine and a uniform tension maintained.

A thread unwinder has been patented by Mr. Thomas Handley, of Willimantic, Conn. This invention provides a flier of simple and cheap construction capable of use with spools revolving at high speed, wherein the thread may be taken from the spool under uniform tension, and from either the top, bottom, or middle of the spool.

An ironing table has been patented by Mr. Samuel H. West, of New Orleans, La. It is designed to be mounted on the edge of a table, and has a swinging clamp and jointed brace, with spring for holding the brace open or closed, the construction being such that the piece to be ironed will be securely held or readily released.

A baling press has been patented by Mr. George Ertel, of Quincy, Ill. It is for baling hay, straw, and similar materials, by successive charges in the bale chamber, the invention providing a construction designed to secure the proper retraction of the plunger while pressing light, medium, or heavy bales in the same machine.

A thill coupling has been patented by Mr. Andrew J. Spicer, of Portland, Oregon. A clip clamping the carriage axle has a tapering dovetailed vertical groove, in which fits an arm jointed to the thill irons, a screw in the arm engaging the clip, the outer end of the screw having an eye and a strap attached to the axle.

A lamp shade has been patented by Mr. Louis Michael, of Leavenworth, Kansas. It is a device capable of adjustment to shade one part of a room while the rest is fully lighted, or it can be used as a reflector, while it is designed to be particularly useful in sick rooms, to protect the eyes of an invalid or infant.

A milk can has been patented by Mr. John H. Bassler, of Myerstown, Pa. The can has double walls, with a binding ring between having lateral projections, and a lid fitting on the binding ring, in connection with a detachable flanged capping ring, being intended to withstand the wear and tear of transportation and rough usage.

A nut lock has been patented by Mr. Hiram P. Pruim, of Grand Haven, Mich. This invention covers a washer having a projection engaging the nut, and a V-shaped key engaging the bolt and a projection on the washer, being a peculiarly constructed washer and locking pin, whereby the nut is prevented from becoming loosened on its bolt.

A shaft coupling has been patented by Mr. Robert J. Stuart, of New Hamburg, N. Y. The coupling frame has a central bridge or seat with double inclined ribs projecting from its inner wall, combined with two opposite wedges and screw bolts for drawing the wedges into the casing, making a coupling that is cheap and strong and easily applied and removed.

A process of dyeing has been patented by Mr. Thomas Holliday, of Huddersfield, England. It is for the dyeing of cotton or other vegetable fibers, in a raw or finished state, by the formation thereon of the colored products of the combination of the nitroso compounds of alpha or beta naphthol with metallic oxides, such as iron chrome and copper.

A burglar alarm has been patented by Mr. Thomas J. Brough, of Baltimore, Md. This invention covers a novel construction and combination of parts in an alarm which is simple in construction and may be applied in a variety of ways to various articles, portable articles as well as doors, windows, etc., and is designed to be produced at a very reasonable cost.

A bracket has been patented by Helen M. Humphrey, of Clayville, N. Y. It is made of a rod with clamping device and lazy tongs attached, in combination with an adjustable plate and set screw, being especially designed for shaving and toilet mirrors and adapted to be attached to a window or other convenient support, and readily foldable in small space.

A whiffletree coupling has been patented by Mr. Lafayette A. Melburn, of Denver, Col. Its construction is such that when the parts are adjusted to position for use, the clip serves as a brace to prevent forward tilting of the whiffletree, the clip being tightened by a nut to take up wear, so that there will be no looseness and rattling of the coupling.

An automatic fire lighter has been patented by Mr. Frank J. Berg, of Dubuque, Iowa. A novel mechanism is arranged in connection with a latch arm or bar fitted to an alarm clock, whereby, as the alarm is tripped, a match will be rubbed over a piece of sandpaper and dropped into paper prepared or other material for kindling a fire at the time set.

A medicated or tonic beer forms the subject of a patent issued to Mr. Moses H. Kluber, of Dodge City, Kansas. It is composed of malt, rye flour, calamus, spearmint, hops, alcohol, lemon extract, yeast, and other ingredients, compounded in certain proportions and made up in a manner specified, for a healthful, palatable, and not intoxicating drink.

A saw handle has been patented by Mr. George N. Clemson, of Middletown, N. Y. The saw blade has a nick in its back and a right-angled slot with vertical extension in its back, while the handle has a slot to receive the blade, with a transverse pin and bolt to engage the nick and slot of the blade, making an inexpensive and easily applied handle for long saws for cutting logs and timber.

A nut lock has been patented by Mr. William H. Van Wart, of Stonington, Conn. It is for preventing the accidental turning of the packing nuts of valves, and differs from a lock nut formerly patented by the same inventor, having an open or split ring adapted to be sprung on the bonnet shank of the valve, with a rigid arm projecting from the ring at one side to engage one of the flat sides of the packing nut.

A combination pool and billiard table has been patented by Mr. Richard L. Rink, of New York City. This invention provides a removable section of cushion rail for insertion at the pockets, whereby the ends of the cushions may be carried back to form the open pocket, or formed in a straight line as a carrom cushion, the invention covering novel features of construction and combination of parts.

A process of drawing on marble has been patented by Mr. Reuben Durrin, of Clay Centre, Kansas. It consists principally in soaking a thin sheet of marble in water, then applying the black—such as crayon sauce or ivory black—upon the dressed surface where the picture is to be drawn, and grinding or cutting away with pumice or other suitable material, until the shadows have the depth, shade, and grade desired.

A hame tug has been patented by Messrs. Stephen H. French and William J. Maltby, of Baird, Texas. This invention covers a tug having a chambered carrier with coiled spring, designed to take up slack when the team is standing or descending a grade, to enable the team to start the load without jerking, and to prevent the collars from working forward on the necks of horses, etc.

A grater has been patented by Flora Pollock, of Baltimore, Md. It is for lessening the labor of comminuting horse radish, cocoanut, dry bread, etc., a can or hopper containing the grater proper, which is operated by a crank handle, while the frame holding the can has depending therefrom a ring or circular frame supporting a bowl or vessel to receive the grated substance.

A rotary pump has been patented by Mr. William B. Allyn, of Boston, Mass. This invention covers an improvement on a formerly patented invention of the same inventor, designed to avoid undue friction between the sliding abutment and the bearing surface of the slot receiving it, and to obviate the necessity of forcing an opening in the web of the piston, which is liable to become choked by sediment.

A tobacco hanger has been patented by Messrs. Thomas Y. and Leo J. Allen, of Skipwith, Va. It is made of wire, bent to form a loop of any desirable shape, with projecting, needle-pointed arms, the loops being adapted to go over the stick or bar, affording a means of hanging the tobacco whereby the breaking and tearing of the leaves is avoided in stripping them from the wires after curing.

A water cooler has been patented by Mr. Solomon Gluck, of Temple, Texas. It has an outer casing and central ice receptacle with perforated bottom surrounded by a water reservoir, with a packing of filtering material in the bottom, and other novel features, the arrangement being such that the water does not come in contact with the ice and the water is filtered before passing to the discharge faucet.

Boat construction forms the subject of a patent issued to Mr. Joseph H. Hunt, of West Troy, N. Y. The invention consists in constructing a boat at the bow and stern with upright timbers having beveled matched edges of such pitch as to conform to and shape the bow and stern lines, the end timbers being fastened by spiking them through and through edgewise one to the other.

A retort gas furnace has been patented by Mr. Dudley D. Flemming, of Jersey City, N. J. Each bench is formed into two combustion chambers by means of a vertical partition wall, in connection with a generator of novel form, and other peculiar features, whereby, through a simple and inexpensive alteration of furnaces now used for direct firing, the advantages of more costly and elaborate regenerator furnaces may be obtained.

A rectifying column for the distillation of liquids and gases has been patented by Mr. Walter E. Colwell, of Cincinnati, Ohio. This invention covers a novel construction and arrangement of parts, whereby a reduced number of sections in the column suffices, increased facility is afforded for varying the capacity of the column, and economy is secured in the use of cooling water, in stills especially designed for the distillation of ammonia gas, and for producing concentrated solutions of ammoniacal salts.

SCIENTIFIC AMERICAN
BUILDING EDITION.

JULY NUMBER.—(No. 33.)

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THE ART REVIEW, George F. Kelly, No. 31 East 17th Street, New York, is a high class journal of art, of quarto size, and published bimonthly, on superb paper. Every number is embellished with a full page etching and several photogravure illustrations, reproduced from paintings by some of our best American artists. Photo-gelatine prints from photographs, representing varied and interesting subjects, add to the value and interest of the publication. The July and August number contains the art news of the season, and a full length portrait of a lady, from a painting by the celebrated artist, William M. Chase, and photogravures from subjects by Kenyon Cox and George Hitchcock, also a "dry point" etching, by Frederick W. Freer, after an oil painting by Carroll Beckwith. All the illustrations in this midsummer number are the contributions of well known artists.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. W. B.—The standard height of drawbars on freight cars from center to rail, as regulated by the Association of Master Mechanics, is thirty-three inches, with a variation of no more than one inch for unloaded cars.

(2) L. W. C. asks whether Babbitt or bronze is best for a bearing for a small shaft running at a high speed. A. Hard bronze made of 3 ounces tin to 16 ounces copper makes the best bearings for small high speed shafts.

(3) U. W. T. asks: 1. What is best to clean tombstones and not spoil the enamel? A. Mix ¼ pound soft soap with the same amount of pounded whiting, 1 ounce soda, and a piece of stone blue the size of a walnut; boil these together for a quarter of an hour; while hot rub it over the tombstone with a piece of flannel, and leave it on for 24 hours, then wash it off with clean water and polish with a piece of coarse flannel. 2. Of what can I make a paint that will not wash off, to paint the letters on a tombstone to represent gold? A. Use the ordinary gold paint sold by art stores, consisting of powdered brass and oil of turpentine. All such paints will wash off in time. 3. Of what can I make a solution to silver-plate brass? A. See the article on "Electro-metallurgy" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310.

(4) G. H. J.—Sulphuric ether gently applied with cotton wool, away from the light, is effective for removing printer's ink from paper, if sufficient pains be taken. Put blotting paper beneath the one from which the ink is to be removed, and use clean white blotting paper to absorb the color after each application of the ether. A weak solution of oxalic acid is used for removing writing ink, with some kinds of which it is effective without materially injuring the paper.

(5) A. E. B.—The saponaceous lotion of the London Pharmacopœia is used as a cosmetic, and has the following composition: Take liquor of carbonate of potassa ½ ounce, olive oil 4 ounces, rose water 12 ounces; agitate together.

(6) L. S. J. and E. F. G.—To get rid of ants in the garden, apply a tablespoonful of carbolic acid to 64 of water to their nests, and they will disappear. To drive them out of the house is more difficult, but can be accomplished by placing red pepper in the places they frequent most, and scrub the shelves or drawers with carbolic soap.

(7) F. A. B. asks how to make the composition used in the manufacture of picture frames (gilt frames). A. Various receipts are used, among others: Mix 14 pounds of glue, 7 pounds resin, ½ pound pitch, 2½ pints linseed oil, 5 pints of water, more or less, according to the quantity desired. Several pages are devoted to this subject in Spons' "Workshop Receipts," first series, which we can send you postpaid for $2.00.

(8) L. H. B. desires a cheap solution with which to make permanently transparent thin bond paper, that it may be used for tracing drawings, etc., one that is easily applied, and of not too fatty substance, that it might resist the ink. A. The paper is first treated with boiled linseed oil, and the excess of oily particles removed with benzine. The paper is then washed in a chlorine bath. When dry, it is again washed with oxygenated water.

(9) M. H. C. writes: In your issue for March 17, 1888, you gave a receipt for making type writer inks with aniline dyes. State in what manner the inks may be kept from fading. A. All aniline inks will fade with time, and in consequence, the government and large firms prohibit the use of aniline inks for important documents.

(10) P. J. W. asks: How is alabaster cleaned that is dirty and fly specked? A. Rub with shave grass, and then with Venetian soap and chalk, stirred into a paste with water.

(11) J. J. C. writes: I am living in a new house and I am troubled with ants; will you please inform me what I should do to get rid of them? A. Bunches of green tansy strewed around are said to be an effectual remedy for those pests.

(12) B. H. C. writes: 1. My son Fred, 13 years of age, has almost completed a motor according to your directions, since his vacation commenced, a few days ago, and is anxious about the battery. A. A plunging bichromate battery may be made by clamping together three plates (5 inches wide and 7 inches high), one of zinc and two of carbon, with intervening strips of wood previously soaked in hot paraffine. The zinc is placed between the carbons, and separated from them by strips of paraffined wood ¼ inch thick, placed at the top. The plates are clamped together by two bars of paraffined wood, which project beyond the edges of the plates and are drawn together by two common wood screws so as to closely bind together the upper ends of the plates and the intervening wooden strips. Before putting the elements together, the upper ends of the carbons should be heated and filled with paraffine for about an inch only. This is best done by rubbing on the paraffine while the carbon is hot. The zinc should be amalgamated by dipping it into a solution of nitrate of mercury. Connection is made with the zinc and carbon plates by inserting strips of sheet copper between the plates and the wooden clamping pieces. The zinc of one element should be connected with both carbon plates of the next element, and so on, and the first zinc plate and last two carbon plates should be connected with the motor. The plates thus prepared are to be plunged into the bichromate solution, which is contained in glass or porcelain vessels. The solution is made in the following way: Dissolve bichromate of potash in hot water to saturation; when cool pour in very slowly one-fifth its volume of sulphuric acid. For every gallon of solution add about one drachm of bisulphate of mercury. The solution should be made in an earthenware vessel. Great care is necessary in handling the acid and finished solution, as they are very poisonous and corrosive. The elements of the battery should remain plunged only when the battery is in use. 2. Allow me to trouble you to tell me the best elementary book on electricity, to get for Fred. Not too elementary. A. We recommend Thompson's "Elementary Electricity."

(13) E. F. F. asks for a process of making chloride of gold from a gold dollar, that will be suitable for photographic purposes. A. Dr. John H. Janeway, an amateur photographer, suggests the following method: Dissolve a $2.50 gold piece in 6 drachms of chemically pure muriatic acid, 3 drachms of chemically pure nitric acid, and 3 drachms distilled water. Put the gold in a large graduate, pour on the acids and water, cover the graduate with a piece of glass, to shut off or retard the escape of fumes, and set in the sun or in a warm place. When the gold is dissolved add bicarbonate of soda, very gradually, stirring with a glass rod at each addition, until effervescence has ceased and the froth subsided, and the carbonate of copper which has been formed is deposited as a green precipitate. Now add 6 ounces of water, and let the whole settle for not over thirty minutes, then very carefully filter the solution. To the clear golden liquid which has passed through the filter add carefully enough nitric acid, chemically pure, to turn blue litmus paper decidedly red, then add enough pure water to make the solution measure 32 fluid ounces. The solution will keep for any length of time, and one ounce will tone four sheets of paper. From Philadelphia *Photographer*.

(14) C. E. S. writes: I have constructed a hand power dynamo as per directions in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and I have succeeded without difficulty. It will bring 5 inches platina wire, No. 36, to a red heat. It will bring four Edison three-candle lamps to incandescence, the armature making about 1,500 revolutions per minute. As I have several pounds of No. 16 and No. 18 magnet wire on hand, I would like to make as large an electro-magnet as the above machine can work to advantage. Please give me the following information: How long and thick should the iron cores be, which size wire do you recommend? The wire is insulated with silk. I have used the same sort on the dynamo. A. Make the cores of your magnets 1¼ inches in diameter and 8 inches long. Attach them to a yoke 1 inch thick, 2 inches wide, and 7 inches long, leaving a space of 3 inches between the cores. Wind each core in two sections, and use ten layers of No. 16 wire in each section. Arranged in this way you can connect all the sections in parallel, or all in series, or two in parallel and two in series.

(15) E. H. B. writes: I have just completed an electric motor such as was described in your SUPPLEMENT, No. 641. It runs very nicely. Would you, through your paper, please answer the following questions? 1. Can it be run by an alternating current? If so, what change must be made? A. The motor cannot be run by an alternating current. 2. What is the difference between the plunging bichromate battery mentioned in your paper and the Grenet battery described on page 72 of vol. i. of "Electricity and the Electric Telegraph," by George B. Prescott? A. There is essentially no difference. 3. Where can I get the carbon and zinc plates, and how thick must they be? A. The carbon and zinc plates should be ¼ of an inch thick. You can procure them from any dealer in electrical supplies.

(16) C. S. W.—Mr. L. O. Howard, acting entomologist, Department of Agriculture, says the specimen is one of the slug caterpillars or stinging caterpillars, of which there are several species common in the eastern United States, especially toward the south. This particular one is the larva of *Lagoa opercularis*. This larva is a very general feeder, although the oak seems to be its particular food plant. It has also been found upon apple, quince, orange, and various other trees. It is not common enough to do any appreciable damage.

(17) S. E. M. asks (1) whether a bed room cannot be perfectly ventilated by one open window, the shutters being closed and the slats of the shutters open, that is, horizontal. I am told that a room to be well ventilated requires two openings, but do not the open slats of the two shutters afford these openings, one for the entrance for pure air, the other for the exit for respired air? A. Whether a room can be ventilated by a single window depends on the size of the room and on many other factors. The shutters only impede ventilation. 2. Can the human voice be cultivated without a master? Are there no books, reliable and good, which one could follow and escape the expense of a music master? A. We believe the voice cannot be properly cultivated without a teacher. We can supply you with "Orthophony, or Vocal Culture," by Professor Francis T. Russell. Price $1.50.

(18) S. S. B. asks: 1. Material saturated with soapy water will not pass through a rubber wringer. What shall I use to squeeze these goods? A. Use a centrifugal drier. This will do the work satisfactorily. 2. Is there any way to neutralize the soapy water in goods that have been scoured more readily than by repeated washings and wringings? A. We advise washing and wringing; chemicals would be apt to do injury. Acids will destroy the soap, but will set free fatty acids harder to dispose of than the soap itself.

(19) K. B. asks: 1. How large should the core and spool be, and what length and size of wire should be used in the electro-magnet for a bell used with about forty feet of circuit? A. Use ⅝ inch round iron for cores, and wind with No. 22 to No. 24 wire, putting on ten or fifteen layers. 2. I have made a little battery for experimenting, consisting of two short electric light carbons and one zinc 2 inches by 1 inch in a solution of common salt. How many cells of this would I want for the bell? A. Use four cells of battery with chloride of ammonium (sal ammoniac) instead of salt. 3. Does it matter in a battery to have the carbon plate small? Does it just increase the resistance? A. The large carbon assists depolarization. It diminishes resistance only if there is a correspondingly large surface of zinc facing it.

(20) J. E. A. asks how much longer time fresh eggs will be preserved or kept good if turned over end for end often than if not so turned at all, and how long they will keep good under different circumstances. A. See the article on "How to Preserve Eggs for the Market," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 317. Similar articles in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 101 and 308 are of value.

(21) F. P. desires a simple recipe for making what is called small beer, in small quantities. A. Take a handful of hops to a pail of water, and add a pint of bran, half a pint of molasses, a cup of yeast, and a spoonful of ginger.

(22) L. K. asks the best way for mending rubber boots. A. Use rubber cement. See formula given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, under title of "Cements."

(23) W. H. C. asks a receipt for making an invisible ink that can be developed with heat and that will fade away when the paper is allowed to cool. A. A mixture of 1 part sulphuric acid with 50 parts of water. The writing is to be done with a quill, and will be, when dry, entirely colorless and invisible, but on heating carefully over a flame, or by laying on a hot oven, it will appear in deep black characters. The marks are indelible. A solution of chloride of cobalt is invisible when cold, and green when hot, and fades away as it cools.

TO INVENTORS.

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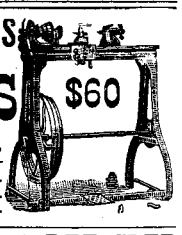

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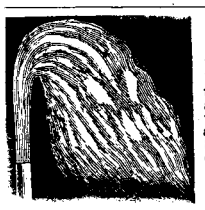

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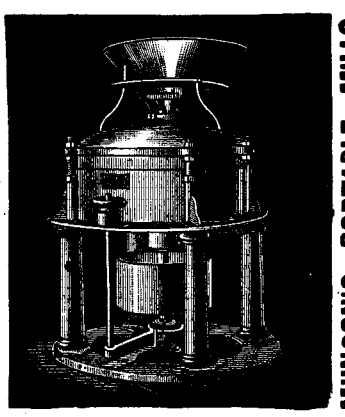

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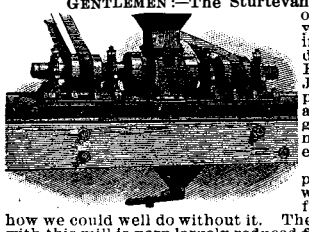

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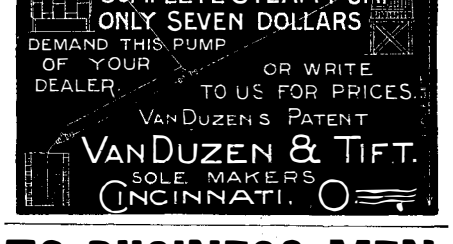

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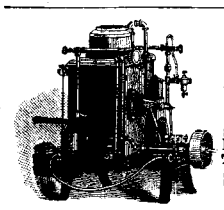

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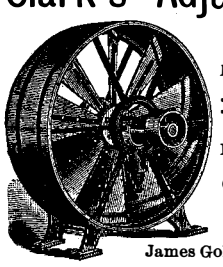

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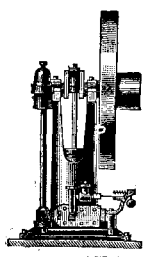

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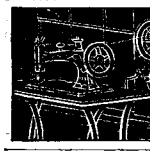

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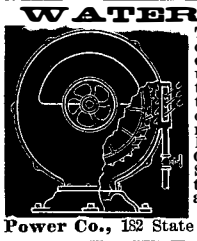

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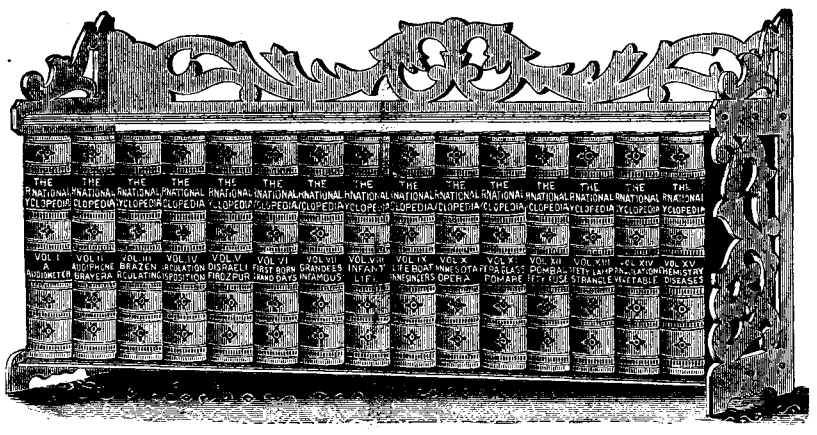

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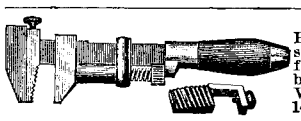

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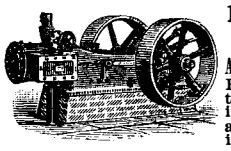

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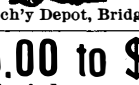
2nd  **MACHINERY** Lists Sent.
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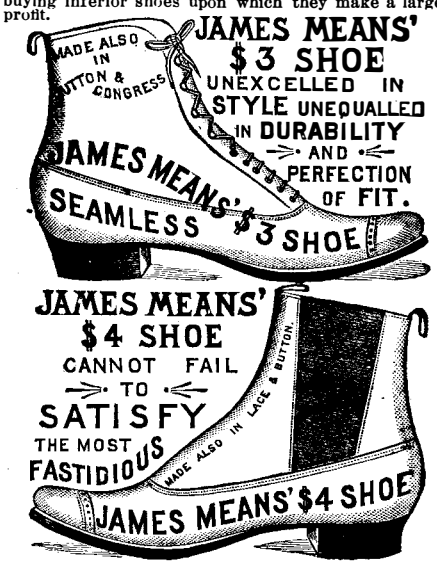
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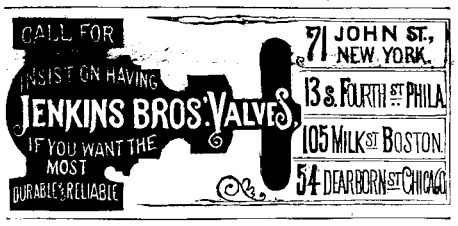
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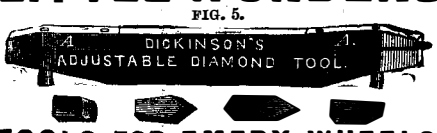

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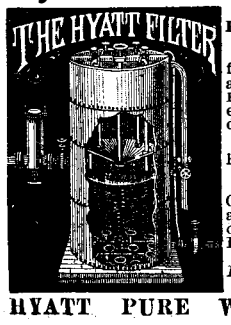

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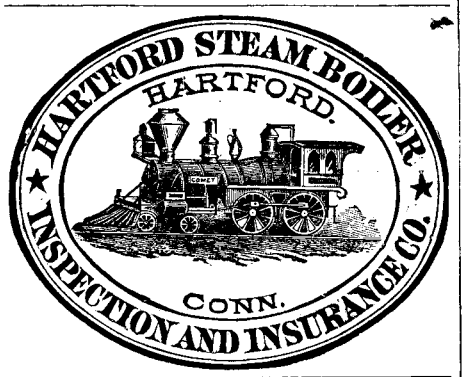

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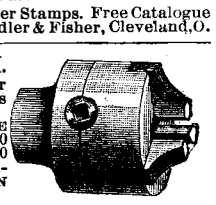

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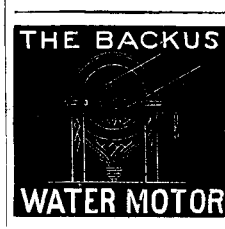

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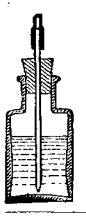

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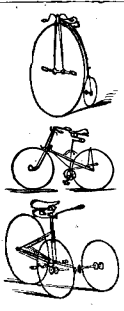

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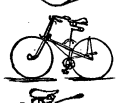

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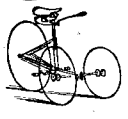

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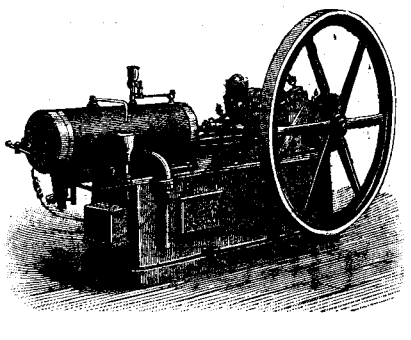

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